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[656 .256 (.494)]

Controlled manual block in Hauenstein Tunnel [1],

By T. S. LASCELLES, engineer, London (England).

Figs. 1 to 8, pp. 1448 to 1452.

(Railway Signal Engineer).

The Hauenstein tunnel in Switzerland is situated on the direct line of the Swiss Federal Railways, between Basle and Olten, and is just over 8 km. (5 miles) in length. Steam locomotives at present are operated through it. The two block stations on either side are Olten-Tannwald junction and Tecknau station. The distance between them is too long to form one block section without causing traffic delays and an examination of the conditions showed that the correct point at which to divide the section was in the tunnel, 3 698 m. (12 130 feet) from the northern end and 4 436 m. (14 550 feet) from the southern portal. The system of block working in use on this part of the road is the « Siemen's Alternating Current Controlled-Manual », used extensively elsewhere on the Swiss Federal lines.

It was, however, clearly impossible to establish a manual block station in the middle of a steam operated tunnel of such a length, so the administration sought to solve the problem otherwise. It was eventually decided to retain the Siemen's block and to establish additional intermediate signals, electrically controlled, in the tunnel, operating them from the Olten-Tannwald signal tower. Mechanical signals were of course out of the question. It was also necessary to know when a train was standing at these signals and to ensure that no train should be admitted to an occupied block.

Unusual conditions encountered.

Figure 1 shows the general arrangement of signals adopted. The northbound section is divided at signal A,

(1) This article refers to the new Hauenstein Base Tunnel, opened in 1916 to ease the gradient to not more than 1 foot in 100 feet between Basle and Olten, and should not be confused with the old tunnel opened in 1858 which is only 1 mile 1 210 yards.

which is worked as an advance signal from Olten-Tannwald, and the southbound section is divided at signal D, which is worked from the same tower

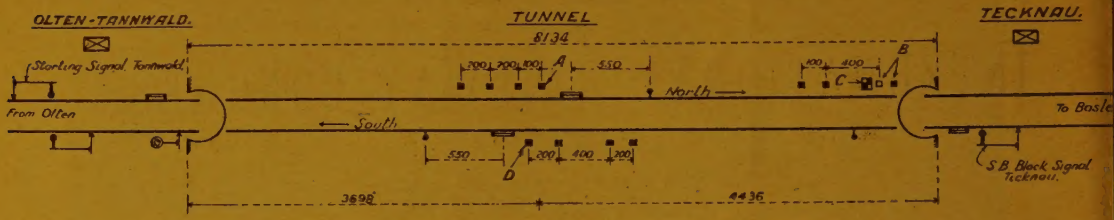


Fig. 1. — Diagram showing location of signals, track instruments and tower.

REFERENCE :

= Special wheel counting track instrument.	B . . . . . = Home signal, Tecknau.
= Ordinary Siemens' pattern track instrument.	C . . . . . = Run-thro' signal, Tecknau.
A . . . . . = Advance block signal, Olten-Tannwald.	D . . . . . = Outer home signal, Olten-Tannwald.

A, *B* and *D* have repeater signals in the rear as shewn.

as an outer home signal. A second train can thus leave Olten-Tannwald when the first has passed and been protected by A, and similarly a second train can leave Tecknau when the preceding one has passed and been protected by D. The home signal at Tecknau, B., and run-through signal C, are also electrical, but the remaining signals are the usual Swiss standard type and worked mechanically. Traffic runs left-handed in Switzerland, but the semaphores, being of German pattern, are right-handed and point over the track like those used on the Chicago & North-Western. Block and home signals show a red or green light and their repeaters, shown on the diagram, green or white, according to the standard Swiss regulations. Signals B and C show the indications as given in figure 2.

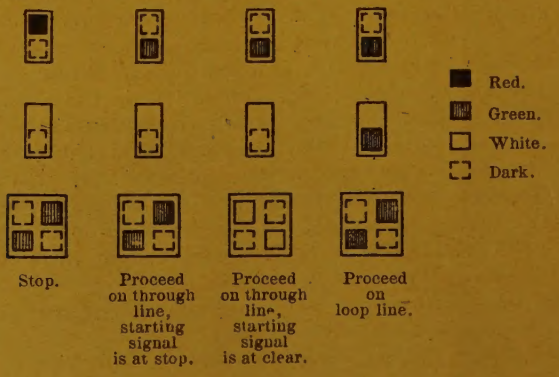


Fig. 2. — Indications of home signal, Tecknau.

It will be evident that it was necessary to prevent the operator at Olten-Tannwald from clearing his northbound starting signal unless the whole of the previous train had cleared the advance signal A in the tunnel and that signal had

been placed at « Danger » — and similarly to prevent his unlocking the southbound block signal at Tecknau until the preceding train had passed entirely clear of his outer home signal D and been protected by it.

The signals are light-signals, shown in figure 3, consisting of two incandescent bulbs of 16 to 25 c. p. in aluminum water-tight cases, the connections being led in by a cable having a plug connection to a terminal box nearby. The change of circuits is made by switches, either fixed to ordinary levers in the machine at Tecknau or small handles in the special intermediate block instrument at Olten-Tannwald.

The most natural solution of the problem of control would at once appear to be track-circuit and this was duly considered by the railway authorities. It was found, however, that owing to the dampness of the tunnel and the great length of the block it would have been necessary to have six cut-sections to the block in order to get reliable working, and it was thought very undesirable to have to keep watch on bonding, rail joints, relays, etc.; in a tunnel so full of smoke and steam. Furthermore, iron ties are used extensively in Switzerland, and this would be impossible with track-circuits.

Wheel counter developed.

It was accordingly decided to try something else and Rudolph Zaugg, engineer of the telegraph service at Berne, designed a wheel-counting mechanism and experiments with it were conducted near Berne. The principle of the wheel-counter is somewhat similar to that used in car-counting street railway signals, such as the Nachod, United States, etc., well known in America. If every wheel that enters and leaves the block is registered, the two operations being equal, it may be assumed that the block is clear. The late W. R. Sykes in England has a patent for such an apparatus in 1904, and made a set which was tried on the Metropolitan Railway.

When the two mechanisms were in the zero position the block was clear. Mr. Zaugg's apparatus is almost identical with that of W. R. Sykes.

The Zaugg counting apparatus is shown at the top of the photograph in figure 4. The two step-by-step movements work a red and a white needle, respectively, and when the block is clear the white needle covers the red one. When a train enters the block each wheel causes the red needle to advance, as shown in the figure, and when the train leaves the block the white needle similarly advances. When the white one again covers the red the block is clear.

In the experiments near Berne track instruments were not used. Instead a very short length of insulated rail, supported by a special chair, was employed, each axle on passing this rail transmitting an impulse to the counting mechanism. These experiments were made with passenger trains and it was thought that no difficulty would be experienced with freight trains. In the tunnel installation, however, this proved to be a mistake. It was found that sometimes with freight trains there would be a discrepancy of one or two wheels between the needles after a train had passed through. Careful investigation disclosed that this was due to flats on the wheels caused by prolonged breaking, these flats making the wheel jump sometimes on the insulated rail, so giving two impulses. The rail was, therefore, given up in favor of the track instrument shown in figure 5. This is not worked by the depression of the rail nor by the wheel flanges, but by the treads of the wheels, the total depression of the contactor bar being 4 to 6 mm. For a speed of 100 km. (about 63 miles) per hour, up to which the apparatus has been worked, the track instrument has to be capable of giving impulses at about

1-22 sec. apart, when counting the wheels of the bogie-trucks in usual service in Switzerland. In order to respond to this the step-by-step movement has to be accurately constructed. After the substitution of the track-instrument for the short

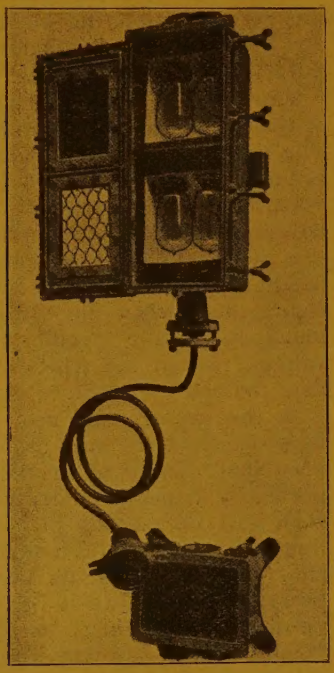


Fig. 3. — Tunnel signal.

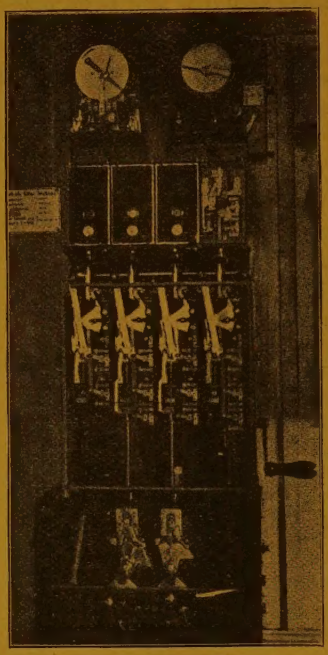


Fig. 4. — Intermediate block apparatus and wheel counters.

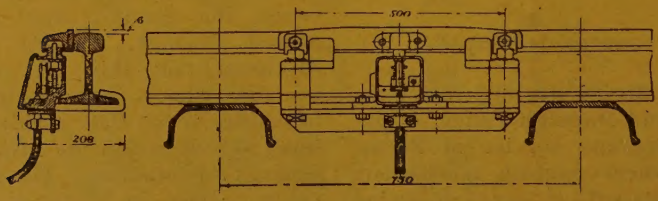


Fig. 5. — Wheel counting track instrument.

insulated rail no further difficulties were encountered.

Operation of the Siemen's System.

In order to understand the application of this apparatus to the Hauenstein installation we must first briefly notice the working of the Siemen's block system. In figure 6 may be seen a diagram of a unit or block-field of this system, with its essential parts. It is operated by alternating-current derived from a magneto. These block-fields may be and

are used for a great variety of purposes in Swiss and German signaling. Each consists essentially of a spring returned plunger D, acting by collar R on a spring-loaded rod E, which in turn locks the signal lever or other apparatus connected with it, as shown. Normally such a lever is free. When the operator has sent a train forward and requires to clear the rear block he must place his own signal to « Danger », then plunge on rod D by pressing the knob and turn the magneto. This sends current through coils C to the other block station and the oscillation of the armature B allows sector A to fall, the half-axle of which then prevents the return of the trigger G. When this movement is completed the operator releases the plunger, which rises. Rod E can only partly rise on account of trigger G and this in turn permits catch J to go beneath the collar R and lock the plunger. The signal is now locked. When the next block station repeats the same operation the incoming current again oscillates armature B and the sector A then rises under the pressure of the spring pushing up the collar L and pin P. When it is completely up the sector axle frees trigger G, which flies back and so allows rod E to rise, releasing the signal. Mechanical locking is provided which automatically holds the lever after its return to normal until replaced by the electrical field-locking, but this is not illustrated. In order to prevent the premature use of the field track-instrument control is also added. The plunger is coupled by a link to an extension rod in a case above the block apparatus and this is controlled by an electric lock so that unless the track-instrument ahead of the block-signal is actuated the plunger cannot be depressed. In the photographs in figure 4 these plunger-locks can be seen above the main block case. It is clear that the Siemen's block can be used to control the use of two successive signals at one tower, if necessary, as is the case in the Hauenstein tunnel.

Combination of the wheel-counter and Siemen's System ensures safety.

With the wheel-counting system special safeguards must be adopted to prevent false indications through failure. If, for instance, the security depended on the wheel-counter only and the first track-instrument were to altogether fail to act, the train would be unprotected. By combining it with the Siemen's block a very safe system has been constructed.

A set of intermediate Siemen's block, shown with the covers removed in figure 4, has been provided to control the two blocks where the wheel-counters are used (see fig. 1). The small handles in front work the outer home and advance signals in the tunnel and are really switches. The fields are coupled in pairs to one plunger, each plunger is locked by *two* plunger-locks, controlled in such a way as to check any failure of the wheel-counters. These, as will be seen, are mounted over the plunger-locks. One of these, on each track, is connected as shown in figure 7, whereby the armature must rise and then fall again in order to unlock the plunger. The others are direct locks and release when the armature is attracted.

Control circuits.

Reference to figure 8, showing the northbound circuits, will enable the working to be understood. Assume the line clear through the Siemen's apparatus being free throughout, and a northbound train approaching Olten-Tannwald. The operator clears signal A, by the ordinary lever in the machine, closing also contact *b*, and clears the advance signal by switch-handle *c*, closing also contacts *d*. Plunger *g* is at present locked by the two plunger-locks *h* and *k*. When the train passes track-instrument

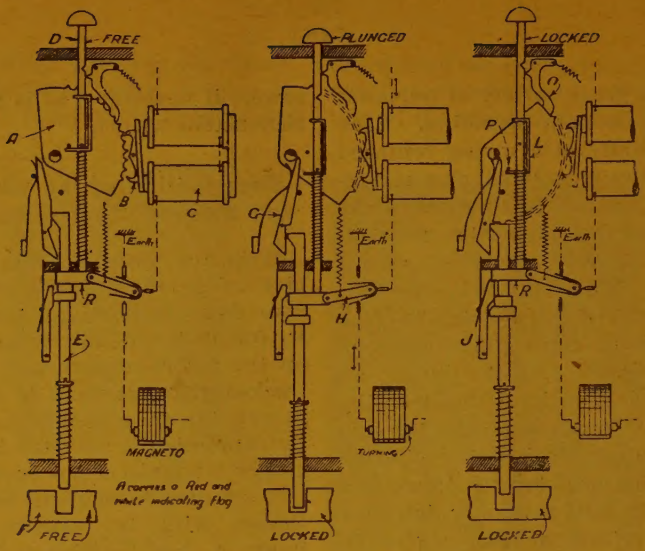


Fig. 6. — Diagram of operating unit of Siemens block apparatus.

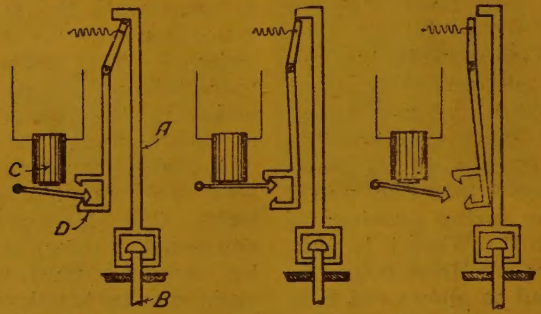


Fig. 7. — Double-action plunger lock.

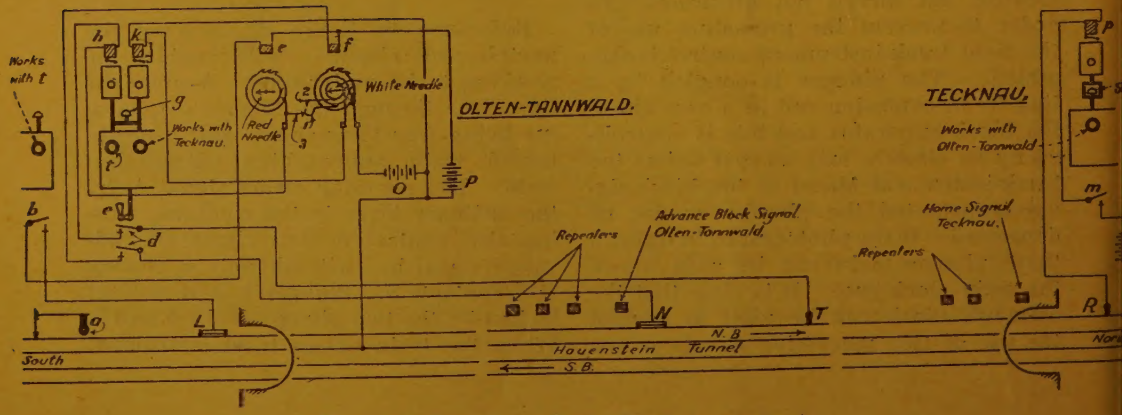


Fig. 8. — Control circuits for North bound signals.

L it works the red needle of the wheel-counter by current from battery P through coils *e*. Directly the red needle moves from beneath the white, contact 1 and 3 is broken and 1 and 2 is made, switching current on to plunger-lock *k*, which, however, only makes half its move, due to the hook mechanism. (If the track-instrument L were broken, therefore, and failed to move the red needle, the plunger lock would still be held.) Signal *a* is replaced when the train has entered the tunnel and is at once held by the Siemen's locking. When the train passes the advance signal it actuates track-instrument N, which causes the white needle to advance with each wheel until it once more covers the red. This opens contacts 1 and 2, cuts current off plunger lock *k* and so releases it. At the same time contacts 1 and 3 being rejoined the circuit is closed to track instrument T (ordinary Siemen's mercurial patterns) 550 m. (1 804 feet) further on. When this is actuated by the locomotive, lock *h* is released. The signalman can now plunge on the plunger *g*, after replacing switch *c*, thus putting the advance signal to « Danger », and by working his magneto he then electrically locks the advance and unlocks the starting signal *a*. This enables him to send another train on if necessary. The reason for employing the extra lock *h* is an important one. It might happen that the first track instrument broke down before recording all the wheels passing over it. In that case the white needle would pass the red one when the train left the block, but at the moment when the two were over one another, lock K would come off as explained and the Siemen's block could be cleared prematurely. The extra lock prevents this as it is only cleared when the train has gone another 550 m. and the needles are at that moment superposed, which would not be the case if the failure referred to had happened. When the train clears the home signal at Technau, it operates track instrument R and releases lock P. The operator can then after seeing the markers and replacing the signal, plunge on S and by working the magneto, clear the field at Olten-Tannwald controlling the advance signal. The working on the southbound track is similar.

Failure alarms and lighting circuits.

In the event of a failure, which leaves the block locked up, the station-masters concerned, after satisfying themselves of the arrival of the train with markers complete are allowed to break the seals of the instrument cases and rest to normal by hand, duly advising the maintainer and inspector. Special switches, locked up, are provided to enable the intermediate working to be cut out and the tunnel converted into a single block, if required. Repeater indicators are provided in the towers for showing if the signals are properly working, and should a lamp go out, that fact is at once indicated by the ringing of an alarm bell.

A very complete telephone system is installed with telephones and alarm signal bells; at each kilometer post (0.62 mile) in the tunnel, also illuminated distance posts are used. The signals are lighted from the alternating current lighting mains, but should this supply fail, accumulators at Olten and Tecknau are at once thrown automatically in circuit. The apparatus was manufactured by the well known firm of telegraph engineers, Hasler A. G. of Berne.

The patent rights for America were acquired by the Bossard Railway Signal Corporation, Troy, N. Y.

[625 .14 & 625 .5]

Permanent way on mountain railways,

By G E. LILLIE.

Figs. 1 to 9, pp. 1456 to 1464.

(*Minutes of Proceedings of the Institution of Civil Engineers.*)

Introductory. — To those who consider the commercial aspect of the engineering profession as of paramount importance, the questions involved in the first part of this paper may seem to be of little interest, mountain railways not being among the big enterprises of the world. There are, however, many who regard the principles and scientific problems involved as the real interest of the profession, the foundation from which commercial and financial interests spring.

In submitting this paper, therefore, the author feels that no apology is needed for the introduction of a subject which chiefly concerns mechanical problems, and which throws many side-lights on railway work in general, necessitating the reconsideration of principles that are only too apt to be taken for granted.

The second part of the paper, dealing with a proposed new form of rail-head, arises naturally from the first, for it is the extreme severity of flange action on hill railways that compels attention to the necessity of an improvement in the standard sections for mountain railways. It would be idle, of course, to suggest its application to railways in general.

Although the capital involved in mountain railways in various parts of the world is considerable, it is not comparable with the vast sums sunk in railways in general, nor is the ton-mileage of traffic to be compared. But the interest in these railways arises rather out of the fact that they involve a reconsideration of all long-established methods, and of almost every item of practical working, building up again on fundamental principles. There is, perhaps, almost more need for elasticity of method in the care of mountain railways than in any other railway work that may be named.

It is also true that many of the lessons learnt on these railways are applicable in a modified form, if not to trunk lines, at any rate to branch lines in hilly and rough country. The difference between hill railways and ordinary railways is only one of degree, and indeed it is not always possible to say whether a given line is a hill railway or not. For the purposes of this paper, however, we are considering a railway of a narrower gauge than the parent line, isolated in the sense that it cannot exchange rolling stock.

Problems affecting mountain railways. — There are, perhaps, two outstanding problems on mountain railways that affect, more definitely than any others, the working of the line, namely :

a) How to get sufficient hauling power on a train, in the case where a narrow gauge and short wheel bases are essential;

b) How to design the permanent way so as to make safe the passage of trains round exceptionally severe curves,

without involving a ruinous expenditure of capital and revenue.

Where steam traction is employed, the first of these problems has led to many designs of flexible types of locomotives, but, at the best, the size of the train has always been limited to far less than that required, for efficient working, by the operating (or traffic) department. Steam traction also involves a limitation of the steepness of the grades, probably necessitating a lengthening of the line and an increase in the capital cost of construction.

For this reason electric traction is usually much to be preferred, for the hauling power obtainable on a single train can be greatly increased by the installation of motors on the axles of the vehicles until, if necessary, every wheel becomes a driving wheel, and grades as steep as the angle of repose could, in theory, be worked. Nor would there be any limitation to the size of the trains on account of the hauling power of the locomotive.

Flexibility for traversing the sharp curves is, of course, assured in electric traction, and it is also very noticeable that flexibility of power is so much greater. Additional electric power can easily be applied to overcome a sticking point (such as a sharp curve) over which a steam locomotive would visibly labour.

The object of this paper is not, however, to advocate any special form of traction, but rather to indicate the difficulty of providing a sufficiently powerful, large unit train to make the operating of the line economical and effective.

Coming now to the question of the permanent way, which more immediately concerns the purpose of this paper, no one can have, even casually, inspected a mountain line without being struck by the extraordinary amount of flange wear on the wheels and sides of the rails on curves. Yet it may be doubted whether the full meaning and cost of this is realized.

On a typical line of this sort, it is not too much to say that the extra cost due to the wear on the sides of the rails, beyond that which may be considered the ordinary wear of the permanent way on railways in general, is about 10 % of the gross earnings of the line. The cost to the locomotive and carriage departments of the extra wear on the flanges of the wheels is probably no less, making a total of some 20 % of the gross earnings of the line. These, of course, are general figures and will doubtless vary a good deal in different cases, but they were substantially true for the Kalka-Simla Railway, when the author was connected with that line.

Further, the cost which this wear entails is not the only cause of anxiety, as, owing to the sharpness of the curves, the lightness of the loads holding the wheels down on the rails, and still more to the peculiarities in the phenomenon of the wear itself, there is an undoubted tendency to derailments, and vehicles are much more prone to leave the rails than on ordinary railways. The author, on taking over charge of the Kalka-Simla Railway, well remembers his first impression in regard to this, but the anxiety was soon alleviated, it is true, upon realizing how quickly the vehicles came to rest when once the 18-inch and 20-inch wheels of the 2-ft. 6-in. gauge rolling stock got on to the ballast.

There were many cases of derailments, two of runaway trains, and one of a curious smash of an empty stock train on the uphill journey, owing to excess speed on a short level stretch caused by the rash driving of a new and powerful locomotive.

None of the derailments led to anything more serious than damage to the rolling stock and the permanent way, but their frequency was one of the anxieties of the early days of that interesting and difficult railway, which

runs through what is perhaps the most mountainous country in the world.

In regard to the danger of derailments arising out of flange wear, it cannot be too clearly emphasized that this danger is chiefly due, not to the tendency of light vehicles to jump off the line when passing rapidly round a sharp curve, but rather to the nature of the wear itself, and nothing could be more fatal than the general attitude of mind which regards rail and flange wear on sinuous railways as a price which must inevitably be paid for the sinuosity, and which therefore neglects any endeavour to reduce it. It cannot, indeed, be too clearly asserted that the wear which is taking place is, in fact, far in excess of what it need be, and is productive of the most dangerous results.

In the first place the trouble arises out of the extraordinary obliquity of the positions which vehicles can, and do, assume in passing round curves when flanges and rails are badly worn. A worn flange crowding hard on to the outer rail of a curve with the usual 3/4 inch slack to gauge is shown in figure 1 (the dotted line representing a new flange on a new rail when the wheels

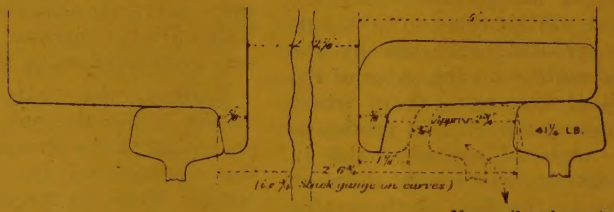


Fig. 1. — Worn flanges passing round sharp curves which are laid 3/4 inch slack to gauge.

are resting centrally on the track which is true to gauge), and it will be seen that the inner flange lies about 2 3/4 inches away from the rail. This, indeed, is not an exaggerated state of affairs, and was common experience on the Kalka-Simla Railway. Now if the position of a vehicle with 6-ft. 3-in. rigid wheel base be shown on the sharpest curve — namely, 120 feet radius — it will be found that the leading outer flange is cutting the rail at an angle of obliquity of 4°, when the flange of the inner wheel of the trailing axle is in the usual running position : that is, just touching the rail (fig. 2). Careful estimates show

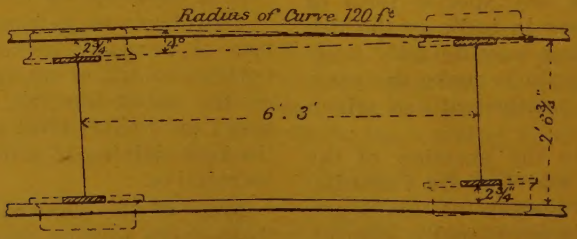


Fig. 2. — Showing four wheel vehicle with rigid wheel base of 6 ft. 3 in. passing round a 120 foot rad. curve, giving an obliquity of 4° when flanges are badly worn, which in practice is increased to 5° owing to the play in the journal brasses.

Note : Section of flanges at level of rail head is shown hatched.

that this angle of obliquity is increased to slightly over 5° by the play of the brasses on the journals, which results in the two axles not lying squarely in front of, and behind, one another, but slightly in echelon, the amount of the displacement being the sum of the play of the brasses on the journals of the leading and trailing axles.

This obliquity is probably the cause of most of the excessive wear, as well as of the unpleasant motion of the vehicle, for an oscillation of 10° round a vertical axis through the centre of gravity can and occasionally does take place.

It may be interesting to point out here a singular difference between British and continental practice in endeavouring to overcome this difficulty. The former endeavours to combat the trouble of obliquity by shortening the rigid wheel bases, and the latter by lengthening them. In the first case it is argued that the shorter the wheel base the more nearly both axles can take up a radial position, for, as the trailing axle automatically runs in a position approximately radial to the curve, the leading axle will be the less oblique the shorter the base. On the other hand, the continental engineers argue that as obliquity is inevitable, it is better to face it and avoid the worse evil of oscillation by lengthening the base, as such lengthening does not always increase the obliquity in proportion (1). This difference in practice is remarkable, and continental rigid wheel-bases are, *ceteris paribus*, 50 to 100 % greater than ours.

The first chief engineer of the Kalka-Simla Railway shortened the wheel base of some of the four-wheeled stock from 6 ft. 3 in. to 5 ft. 3 in., whereas the chief engineer of the Montreux-Oberland-Berne Railway (a railway of remarkable similarity to the former, with metre instead of 2-ft. 6-in. gauge, and with 130-foot radius curves instead of 120 feet) lengthened the rigid wheel bases of their four-wheeled vehicles from 11 ft. 9 in. to no less than 17 feet. The result was that on the former line the vehicles were reported to run so badly that they were altered back to 6 ft. 3 in., whereas on the latter the running of the vehicles was reported to be much improved. Astounding as these results may seem to be to British engineers, there is undoubtedly a good deal to be said for the continental practice. The supersession of four-wheeled vehicles by bogies on all hill railways, however, renders the point of less practical interest.

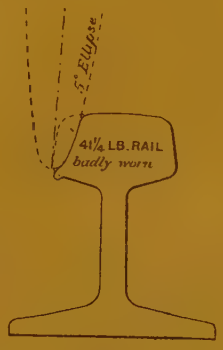


Fig. 3.

Figure 3 shows the section of a rail, on the worn surface of which is inscribed a 5° ellipse, which, it will be noticed, fits the worn surface with remarkable accuracy. This represents the cutting effect of the edge of the flange on the side of the rail, for the circle, which constitutes that cutting edge, projected through an angle of obliquity of 5°, presents the ellipse in question, and forms a most perfect tool for cutting away the side of the rail head to fit that ellipse. This is not a question of fair wear and tear, it is deliberate cutting, which may be largely eliminated by

(1) This is true in some cases. As an example, an increase in the length of the Kalka-Simla Railway, 6 ft. 3 in. rigid wheel-bases to anything short of 8 ft. 4 in. would rather decrease than increase the 4° angle of obliquity.

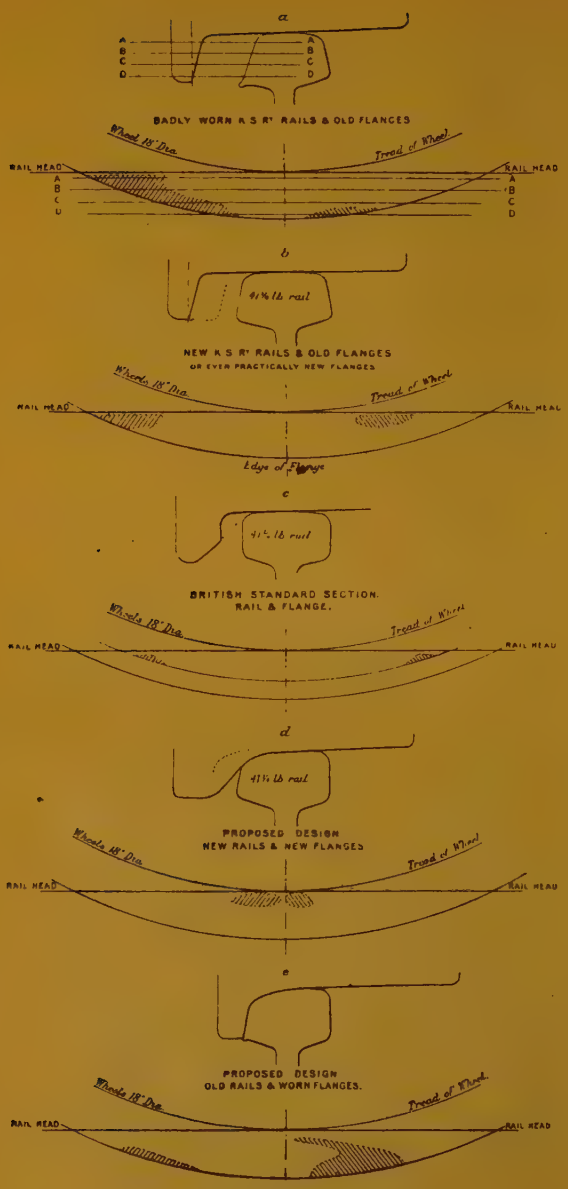


Fig. 4.

/// Points of contact between flange and railhead for an obliquity of 5° (Wheel moving to the left).

\\\ Points of contact between flange and railhead for an obliquity of 2° (Wheel moving to the right).

remedial measures, the first of which is the adoption of bogie under-carriages instead of the four-wheeled rolling stock. The bogie truck lies up against the outer rail, with both outer wheel flanges touching it, and, though the leading wheel flange presses a good deal harder than the trailer, the angle of obliquity either disappears altogether or is considerably reduced. In the locomotives adopted on the Kalka-Simla Railway, an excellent design of bissel truck for the leading and trailing ends produced a somewhat similar result.

In the next place the locomotive and carriage department might endeavour to prevent the cutting edge itself. It is, of course, not to be expected that they should put all the wheels on the lathes and turn off this edge at frequent intervals, but, on the other hand, the brake blocks might be made to engage with this edge as well as with the tread of the wheel without touching the throat of the flange. All wheels on such railways are braked, and a very reasonable alteration in the shape of the blocks would provide an excellent means of rounding off the edge which does so much harm. Finally it is desirable to adopt a shape for the flanges of the wheels and for the rail-heads that will prevent this cutting for any reasonable angle of obliquity.

The points of contact between flange and rail-head when the obliquity is 5° and 2° respectively may be seen in the cases of a worn flange passing over a worn rail, and of a new flange passing over a new rail, in figure 4*a* and *b*. In this figure it should be noticed that, as a matter of convenience, points of contact for these two angles are shown crosshatched on the opposite sides of the centre line. The position of the contacts were ascertained from sectional plans on lines AA, BB, CC and DD (fig. 4*a*).

Figure 4*c* shows the result of adopting British standard rail-heads and flange-sections on such a railway, a most undesirable section, it is true, on account

of the vertical sides of the rail-head. With such a section of rail a groove would be worn within a month or two in the fillet of the flange, with the very bad results indicated. It should be especially observed that the position of contact is as bad for the 2° obliquity as for 5°, and this, of course, is the direct result of a vertical sided rail-head, the advantages of which it is hard to conjecture and the disadvantages of which are obvious. Indeed, the vertical sided head and the extreme dissimilarity between the radii of the corner of the rail and the fillet of the flange, adopted by our standardization committee and so warmly supported by the American writer, A. M. Wellington, are only consistent with the conception that no wear whatever occurs. This assumption is the more astonishing, inasmuch as the obvious endeavour of the design is to restrict the area of flange contact as nearly as possible to a point, thus involving an intensity of pressure as enormous as the area of contact is small.

A design of rail-head and flange is now submitted, in which the side of the rail-head and the flange are made to the contour of a tractory curve (fig. 4*d* and *e*). From these it will be noticed that the position of contact is not so ready to leave the centre line, and also that the area of contact is not so unduly constricted when wear has taken place.

The British standard rail, shown in figure 4*c*, with its vertical sided head, square corners and the large radius fillet of the wheel flange, was designed, it is believed, in accordance with the principles propounded by the American writer, A. M. Wellington. Briefly the explanation is as follows :

So long as the radii of the flange fillet and corner of the rail are made quite dissimilar and contact is thereby limited approximately to a point, the outer wheel lifts off the tread when passing round a curve, and contact only remains between the corner of the rail and the fillet of the flange, thereby virtually increasing the radius of the outer wheels, and so negotiating the curve without slipping.

In reply to this argument it may be said :

a) If the materials of which rails and tires are composed could safely withstand pressures of 50 or 100 tons per square inch without detriment, there would be a good deal in favour of the arrangement. The best commercial steel, however, from which the rails and tires are made, cannot stand this pressure, and the fibres will inevitably be crushed. The result is that so far from Wellington's statement being correct, that « it will require four times the tonnage to account for a given unit of wear before that corner is worn off than it will afterwards », it is neither in accordance with reason nor with known facts.

b) Inasmuch as it has been shown by Wolley Dod and other writers (including Wellington himself) that the horizontal pressure of the flange against the rail is independent of the radius of curvature of the track, being about 0.6 of the weight on the wheel for normal values of the coefficient of dry friction, the fillet of the flange will run up against the rail to the same extent for all curves. In other words the point of contact is the same for all radii of curvature, consequently the increase in the virtual diameter of the outer wheel, although it will suit one particular radius of curvature, will not suit any. others. Hence sliding must, and does, take place, under a pressure of 50 tons or more per square inch, which the author calculates is by no means an over-estimate of the pressure at the point of contact with a new flange and rail. It can hardly be wondered that initial wear in such cases is tremendous.

c) Great dissimilarity of radii is not necessary to cause the wheel to lift off the tread, and this advantage, such as

it is, can be obtained without paying such a high price as one-point contact involves. It must also be remembered that this one-point contact affects rails and tires adversely on the miles of straight line as well as on curves, whereas the hypothetical advantage is only applicable to the outer rails on curves.

New section for rail-head. — From all this it would surely seem that the principle on which the British standard section rails are designed is wrong; that a revised and rational section of rail and wheel flange should be produced; and that this design, though it is of course impossible to hope to introduce it on trunk lines, should be adopted on mountain lines and other isolated railways that do not exchange rolling-stock.

The object to be aimed at in designing such a new rail head is to obtain a section that will give the least wear for a given tonnage carried by wheels with flanges correctly shaped to suit the rail. Flange action is without doubt the crux of the situation, and the top of the rail must be merely more or less flat to take treadwear.

It is submitted that the section which will comply with this stipulation, and give the least wear is that section which will tend to retain its shape during wear: in other words the shape which the wear itself is tending to produce. If such a section be adopted the action under a new tire is the same as that under an old and worn one, whether the rail be new or old, and there will be a good fit between rail and flange at the corner of the rail. This fit is essential, for it is impossible that wear can take place at points where there is no contact, just as it is impossible to believe that we have arrived at the natural curve which wear is tending to produce if the various flanges, new and old, are bearing at different points and producing irregular wear. Moreover, it is only when a good fit has been obtained that pressure is evenly distributed, instead of, as at present, being excessively high at various points : a state of affairs that must produce rapid wear. It may, of course, be readily admitted that in the case of a very much worn flange the contact will extend far lower than is contemplated in a new section, and will in consequence produce imperfect action, but this will be dealt with later, as a second consideration in the design.

Application of tractrix curve. — It is clear that any reasonable sort of curve for the flange and the rail corner which makes a fit, will not fulfil these conditions, as the wear is taking place under regular mathematical laws and the curve will therefore have to be made some definite mathematical shape.

The wear at each point of any two surfaces in contact will be, provided the material is homogeneous, proportional to the intensity of pressure at that point and to the speed of rubbing of the surfaces on one another.

If, therefore, the surfaces of flange and rail fit correctly and give an even distribution of pressure, the wear at each point will be proportional to the rubbing. By wear is meant the amount of metal worn off each element of surface, and that in turn means depth of wear measured normal to the surface.

If the curve is designed, therefore, so that the horizontal projection of the varying depth of wear is, by virtue of the varying angle of inclination of the surface, a constant quantity, the wear will cause only a horizontal displacement of the curve without distortion, and the object sought will have been obtained, namely, a section which will retain its shape during wear. Thus in figure 5, if CDB be the curve required and $C_1D_1B_1$ shows the position of the same after wear, then the two curves are the same if $CC_1 = DD_1$ and is constant at all points on the curve. This will be so, if $Dn \operatorname{cosec} \theta$ is constant, that is, $Dn \operatorname{cosec} \theta = DD_1 = CC_1$; where θ is the varying

angle of inclination of the curve, and D*n* is the varying depth of wear.

Now the relative motion between the flange and the rail is that arising out of the fact that, at each instant the wheel and flange are rotating round an instantaneous centre or axis, which is a line joining the points of tread contact of the two wheels of one axle on the tops of the rails. The rubbing at any point is therefore proportional to the distance of that point from the instantaneous axis. If in figure 5 AB is the instantaneous axis the rubbing at D is proportional to D*e*, that is, D*n* = K × D*e*, where K is a constant.

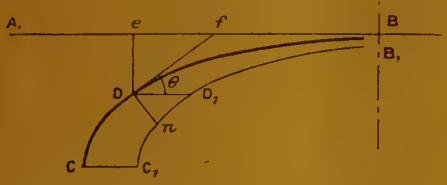


Fig. 5.

The two right angle triangles D*ef* and D*n*D$_1$ being similar, it follows that DD$_1$ = K, D*f*, or $\frac{DD_1}{Df}$ = K, and if DD$_1$ is to be constant, so also must D*f*.

The curve must, therefore, be a tractrix, and the line AB its asymptote. This will be more clearly understood when it is remembered that a tractrix is, by definition, the curve traced by a point D when taken in tow by an object passing along a line AB, and the constant length of the tangent D*f* is the length of the tow line.

Consequently, if the rails are rolled so that the corner is a tractrix, of which the asymptote is the horizontal line passing through the highest point of the railhead, and if the flanges of the wheels are cut to fit this curve, we shall have the shape that the wear itself is tending to produce, and the rail and flange will retain their form throughout the process of wear.

The case is, indeed, precisely analogous to that of a pedestal which, if the bottom of the shaft is turned square, will quickly wear to a rounded surface which bears unevenly. If, on the other hand, it is cut to the shape of a tractrix the wear will be even (fig. 6).

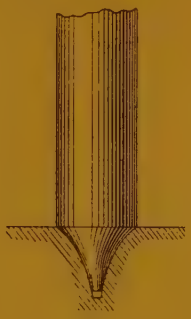


Fig. 6. — Diagram of a pedestal with the foot cut to a tractrix.

It should be noted here that a slight error occurs in the action on the outside rails of curves, for the motion round such curves is a compound motion of rotation round the instantaneous axis as for the straight portions of the track, together with a sliding forward of the wheel on the outer rail. It is this latter motion which constitutes the irregularity. It need not be anticipated, however, that the momentary sliding forward of a tire on the rail, which it fits exactly, will cause a wear that will distort the surface; it will cause an even wear all over the surface of contact, and, indeed, it may be confidently expected that rails and wheel tires, shaped as above, will retain the shape with fair accuracy during wear.

Selection of the tractrix curve. — It now only remains to select the particular tractrix that will best meet the requirements, and the first question is how far down the flange, below the tread, must contact extend in order to provide for flange action. It is, of course, a

question of the intensity of pressure permissible. In view of the fact that the further the extension down the flange the greater the rubbing, it would be very desirable to limit this area, but a considerable area of flange contact is necessary as the flange pressure, which has to be transmitted, is considerable; and it is not feasible to limit the maximum intensities of pressure to a lower figure than that obtained for tread pressure.

Now the maximum intensity of tread pressure on a metre-gauge railway, loaded up to the government of India rule, which allows 3 tons load per foot of wheel diameter, was calculated by the author in a Government memorandum to be about 8 tons per square inch. That was, taking the modulus of elasticity for rail and tire at 15 000 tons per square inch, and assuming the length of the surface of contact across the rail-head to be 1 inch. It will, therefore, be wise to aim at about the same maximum intensity of pressure for flange contact.

As already mentioned, the maximum flange pressure is the same for all radii of curvature of track, and assuming the coefficient of dry friction to be 1/4, is about 0.6 of the weight on the wheel. Thus, in order to get the same intensity of pressure, the area of flange contact should be about 0.6 that of head contact.

It is not possible to make an exact computation of the area of flange contact, however. Figure 4*d* shows that area for stated angles of obliquity, but the exact extent of this will be affected by the elastic deformation of the fibres in contact, and a drawing, however accurate, cannot deal with such minute measurements.

The area of tread contact on the other hand is susceptible of computation, as also is its length along the rail, and it is relevant to point out that this length is greater in the case of flange contact than in that of tread contact, for the former is more glancing than the latter. The first is the case of a wide angle cone coming against a straight rail and the latter is merely a cylinder resting on a plane surface. In the case previously referred to, the maximum length of the contact along the rail, which varies directly with the radius of the wheel, is about 0.9 inch on a 20-inch diameter wheel, or 0.8 inch on an 18-inch diameter wheel, when the maximum pressure is 8 tons per square inch.

It follows that the length of flange contact will be greater than this. The actual average radius of curvature of the face of the flange in horizontal sections through various points in the area of contact is about 18 or 20 inches, and is thus about twice that of the wheel which produces the above-mentioned tread contact. The curvature of the rail also tends to lengthen the contact, for the pressure is against the inside or concave edge of the rail on a curved track.

The length of flange contact may, therefore, be regarded as about double that of tread contact with the same intensity of pressure, and thus the width of flange contact may be made half of that on the tread. Only 0.6 of the area is required, however, for flange contact to give the same intensity of pressure, as the total horizontal force is only 0.6 of the vertical force on the rail, as previously stated. Hence the width of flange contact should be 1/2 × 0.6 × width of tread contact.

The latter has been taken at about 1 inch when calculating the maximum pressure mentioned above, so that the depth down the flange to which contact is to extend should be 0.3 inch to give the same maximum pressure. Three-eighths of an inch has been taken in the designs for the 41 1/4-lb. rail in the diagrams. It is possible, however, that in the case of rail-heads for hill railways 1/2 inch would have been better, on account of the heavy flange wear, whereas for standard gauge rails 5/8 inch or 3/4 inch will be ample.

Plotting the tractrix curve. — In the class-room the tractrix is drawn as the involute to a common catenary, but the latter not being an easy curve to draw the following is suggested as the simplest way to plot a tractrix (fig. 7).

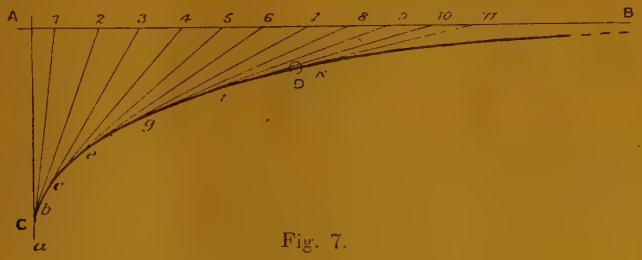


Fig. 7.

AB and AC, two lines at right angles, are taken as the axes of X and Y, and AC (3/8 inch as above for the 41 1/4-lb. rail) as the constant tangent, the length of the tow line. The whole curve is a quadruple arc with cusps on the axis of Y where the tangent is vertical, but, of course, only one quarter is needed.

Take points 1, 2, 3, etc., equally spaced along AB, A to 1 being only a half length. C1 represents the mean position of the tow rope whilst the towing body travels its first unit distance along AB. Set off on C1 from 1 the constant length and we get point *b* on the curve; join this to point 2 and AB and the mean position of the tow line during the second unit distance travelled by the towing body is obtained, and so on.

This gives a set of tangents to the curve, but the method is liable to cumulative errors, so that a true point on the curve should be calculated from the equation. If the curve does not pass through the true point (a small error will be observed in this case), it must be moved till it does, when for practical purposes it is correct.

It will be observed that the line AB is the asymptote to the curve, and it will be necessary to stop the tractrix at about one-third the width of the rail-head from the inner edge and run on in the tangent in the line AB, for that line must form the top of the rail-head, as it was on this assumption that the investigation was carried out. The action will not be affected appreciably, for the deviation will be small and so high up as to be clear of flange action, and it is only for flange action that a tractrix is necessary; tread action will be satisfied with any flat curve.

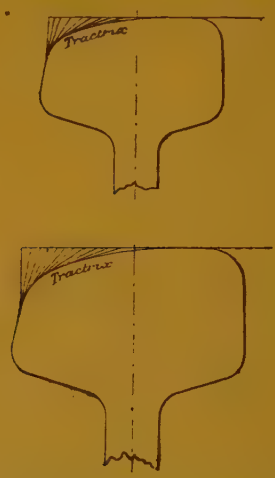
With this curve drawn the inside edge of the rail may be completed by drawing a line at a slope of 1 in 6 in case of the rail-head, and at about 50° in case of the flange tip, downwards to complete the contour. This slope will keep the flange tip well away from the side of the rail and the tongue rails of switches, whilst the slope of 1 in 6 on the rail side will prevent the worn part of a badly worn flange actually exhibiting the worst features of the cutting already referred to, when it has worn to a cutting edge, and when serious obliquity of motion occurs.

Figure 8 shows the proposed design of rail-head for the 41 1/4 lb. and the 75 lb. rail.

Further advantage may be expected from the adoption of this design, namely, that for a given amount of wear the quantity of material that has to be cut off the tire, on turning up in order to restore the correct gauge, is slightly less than half of what is necessary with

British standard section rails, thus more than doubling the life of the tire, figure 9.

Proposed form of 41 1/4 lb. rail.



Proposed form for Indian standard gauge, 75 lb. rail.

Fig. 8.

reason for the canting now disappears. This, of course, will much simplify the laying.

Conclusion. — Summing up, it may be claimed for this form of rail that :

a) A rational shape has been obtained that will be maintained throughout wear, giving an even bearing throughout its life;

b) The intensities of pressure will, therefore, be much less than in present practice, and the wear much less rapid in consequence;

It should be noted that these rails should be laid flat on the sleeper or bearing-plate, and not canted, as the

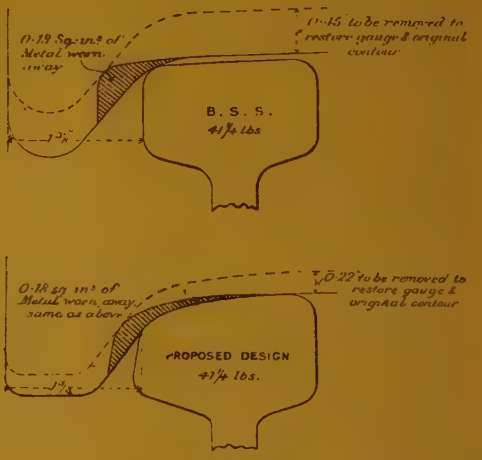


Fig. 9.

c) That owing to the fact that the gauge may be restored on turning up, by only half the present depth of cut, the life of the tires for this reason alone will be doubled;

d) That the cutting action on sharp curves and facing points will be, if not entirely eliminated, very much reduced and the danger of derailments will practically cease;

e) That for the first time a rational design is introduced which is consistent with flange action on the straight portions of the track, with the consequence that many of the frequent signs of bad running will be eliminated, as well as serious, unnecessary wear at present obtaining on such sections.

[624 .52 (.944)]

Proposed cantilever bridge at Sydney, New South Wales.

Figs. 1 to 10, pp. 1466 and 1468.

(*Engineering.*)

During the past forty years much discussion has taken place and many proposals have been considered by the authorities in New South Wales for providing suitable means of communication across Sydney Harbour to accommodate the growth and development of Sydney. Public tenders and designs have been invited, and awards made for the best proposals submitted on several occasions, but no definite steps have been taken to carry out any of them. Low and high-level bridges, floating bridges and tunnels have been investigated and postponed. The development of Sydney has proceeded, and sites, formerly suitable, had to be abandoned, and new and more costly schemes considered.

The decision of the Government to adopt a bridge, in preference to other means of crossing the harbour, was arrived at in 1913 after a report had been submitted on the subject by Mr. David Hay. This report was accepted by the Government, though in the interval which has since elapsed some modifications would appear to have been introduced.

Tenders and designs are now invited by the Department of Public Works, New South Wales, for the construction and erection of a cantilever bridge from Dawes Point to Milson's Point, carrying four lines of railway, a main roadway 35 feet wide between the kerbs, a motor roadway 18 feet wide, and a footway 15 feet wide across Sydney Harbour with approach spans, having a total length of 3 816 feet centre to centre of abutments. The headway required for shipping will be 170 feet at high water for the central 600 feet of the bridge. The bridge is to consist of steel cantilevers spaced 98 ft. 6 in. apart centre to centre, with shore and harbour arms, each 500 feet long, the harbour arms supporting a central span 600 feet long. The clear span from centre to centre of the main piers will be 1 600 feet.

The cantilever and suspended span is shown in the accompanying elevations, plan and sections (figs. 1 to 4), has « M » bracing, and each panel is divided into four members, having cross-girders pitched 37 ft. 6 in. and 50 feet apart centres. The cross-girders are cantilevered out beyond the main girders to carry the motor roadway and footway.

Each of the three spans on the southern approach consists of four « M » type deck trusses with subdivided panels, 204 feet long, centre to centre of end posts, and spaced 30 feet apart centre to centre transversely. The cross-girders are spaced 17 feet apart centre to centre and rest upon the upper chords of the trusses and are cantilevered beyond the outer trusses. The three spans on the northern approaches are similar to those on the southern approaches, except that the approach is on a curve of 8 chains radius.

Tenderers are allowed the greatest latitude in the design of the bridge, which may result in economy in cost, and may submit proposals with that end in view. The cantilevers, girders of suspended span, cross-girders of the main bridge and girders of the approach spans may be constructed wholly of carbon steel,

Fig. 1. — Plan of site.

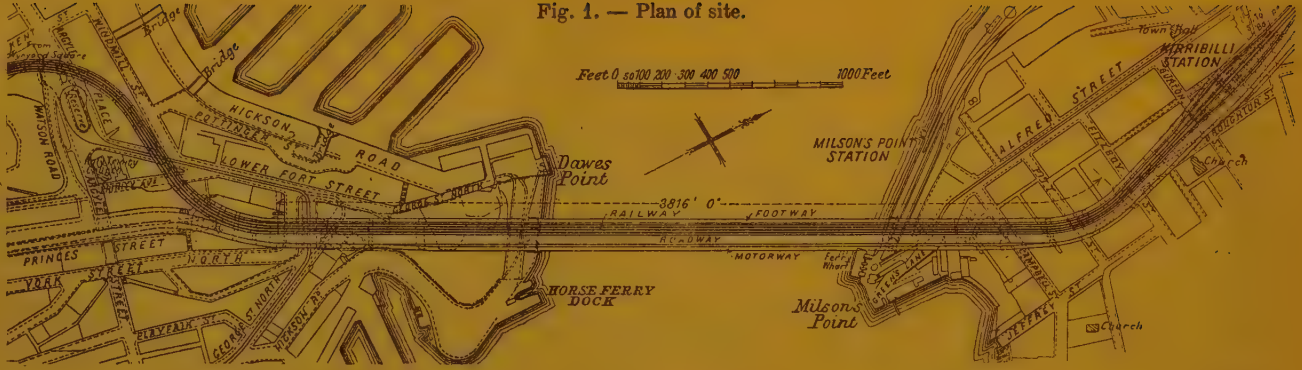
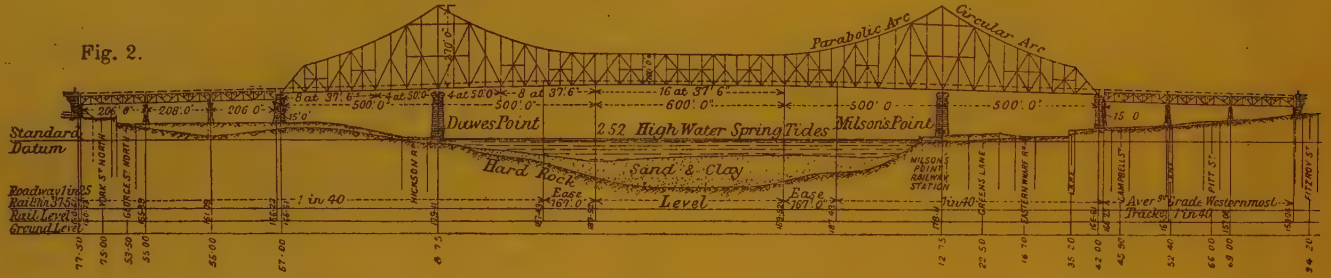


Fig. 2.



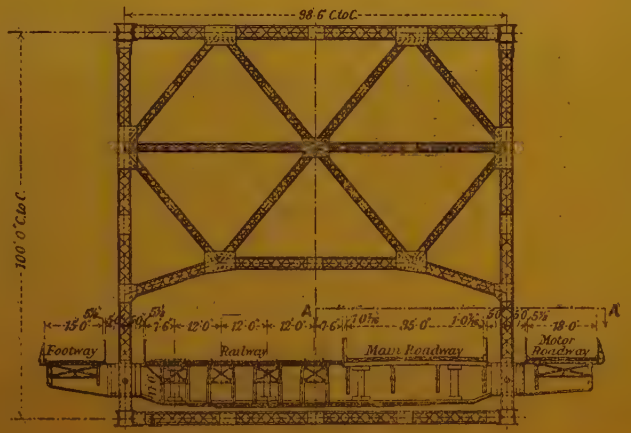


Fig. 3. — Cross section.

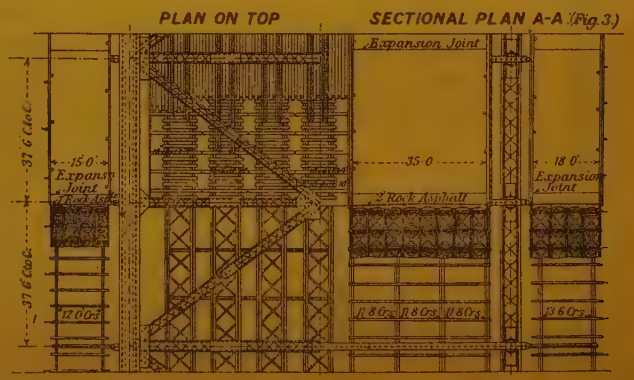


Fig. 4. — Details of suspended span.

nickel steel, chrome nickel steel, or partly of any of them, as determined by the tenderers. The bridge may be built wholly of riveted members, or the tension members may be constructed of eye-bars and pins. The main piers, anchor piers, and piers and abutments of the approach spans, are to be constructed of concrete faced with granite masonry. The contractor has to satisfy himself as to the sufficiency and suitability of the design, plans and specifications and to undertake entire responsibility for the materials, construction, design, specifications, calculations, and plans furnished to or by him.

For the information of tenderers tables are given of the range of temperatures and intensities of prevailing winds, and the extreme velocities and pressures recorded during the severest storms in Sydney. A period of seven years is given for the completion of the work.

In view of the fact that a British Engineering Standards Committee has in hand a standard specification dealing with loading, etc., of bridges, we append extracts from the specification prepared by the chief engineer, Mr. John J. C. Bradfield, M. Inst. C. E. :

Loads and stresses to be adopted in the design of bridge.

Dead load.

In estimating the weight of the structure, for the purpose of computing the stresses therein, the following unit weights shall be used.

	lb. per cubic foot.
Asphalt rock	150
Concrete, stone	150
Concrete, coke, including floating	84
Granite	170
Steel, rolled	490
Steel, cast	485
Wrought-iron	480
Cast-iron	450
Timber, ironbark or grey gum	75

	lb. per lineal foot
Rails and fastenings	35
Guard rails and fastenings	32

The dead load shall consist of the entire weight of metal and other materials in the structure, computed in accordance with the above unit weights, with 2 % addition to the calculated weight of steel for over-run.

Live load.

All live loading or any combination thereof to be arranged to produce maximum stresses.

The deck system is to include the flooring plates, transverse rolled steel joists, stringers, the cross-girders and the ends of cross-girders cantilevered beyond the main trusses; also any submembers and connections of the main system which may be more heavily stressed by the loading specified for the deck system than by the loading specified for the main system.

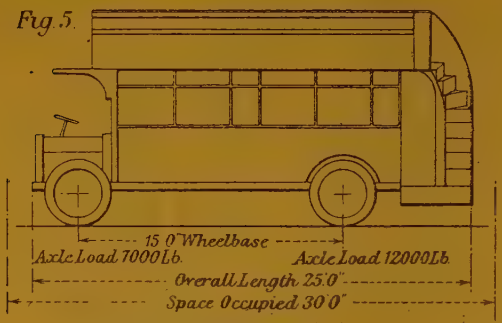
The main system is to include all members of the cantilevers, girders of suspended span, and girders of approach spans, other than those specified under deck system.

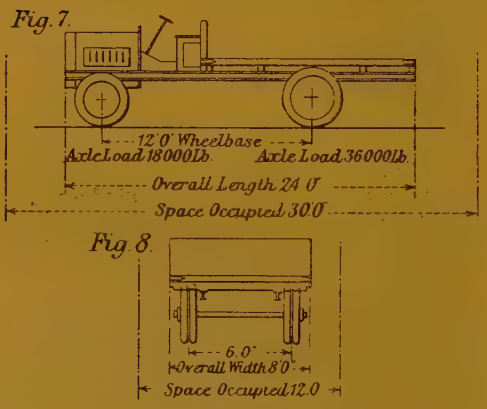
Deck system. — To be designed for the stresses produced by a uniform load of 100 lb. per square foot over the footway.

Main system. — To be designed for the stresses produced by a moving load of 450 lb. per lineal foot of bridge of such length as may be required to produce maximum stresses in the various members.

Deck system. — To be designed for the stresses produced by a uniform load of 100 lb. per square foot over the motor roadway, or for the concentrated loading of two motor buses side by side, heading in opposite directions. Wheel base, 15 feet by 6 feet. Load on front axle 7 000 lb., back axle 12 000 lb., wheel bases 8 feet centres. Space occupied by

two 'buses side by side, 30 feet by 18 feet. (See figs. 5 and 6.)





Figs. 5 to 8.

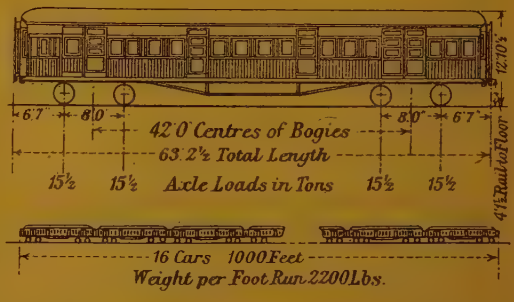
Main system. — To be designed for the stresses produced by a moving load of 700 lb. per lineal foot of bridge, of such length as may be required to produce maximum stresses in the various members.

Deck system. — To be designed for the stresses produced by a conventional motor lorry (figs. 7 and 8), wheel base 12 feet by 6 feet; overall length 24 feet; overall width 8 feet, space occupied 30 feet by 12 feet. Weight, front axle 18 000 lb., back axle 36 000 lb. The remainder of the roadway to be covered with a live load of 100 lb. per square foot.

Main system. — To be designed for the stresses produced by a moving load of 2 450 lb. per lineal foot of bridge, of such length as may be required to produce maximum stresses in various members.

Deck system. — To be designed for the stresses produced by two coupled conventional electric locomotives, each 65 feet long overall and weighing 160 tons, followed by a train 1 000 feet long weighing 2 200 lb. per lineal foot on each of any two tracks of the four tracks, the remaining two tracks each carrying a train consisting of multiple unit stock, overall length of train 1 000 feet, weight 2 200 lb. per foot. (See figs. 9 and 10.)

Fig. 9. — Multiple unit car and train.



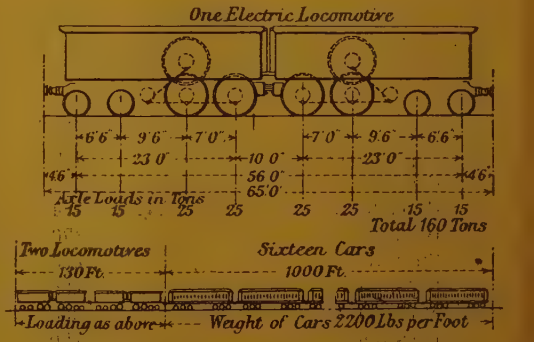


Fig. 10. — Electric locomotive and train.

Main system. — To be designed for 80 % of the stresses produced by two coupled conventional electric locomotives, each 65 feet long overall and weighing 160 tons, followed by a train 1 000 feet long weighing 2 200 lb. per lineal foot on each of any two of the four tracks, the remaining two tracks each carrying a train consisting of multiple unit stock, overall length of train 1 000 feet, weight 2 200 lb. per foot. (Figs. 9 and 10.)

Impact.

Impact to be added to the statically computed maximum live load stresses produced by the electric railway loading as under :

	Per cent.
Railway stringers.	50
Floor beams and members of main system carrying one panel load or less	40
Members of main system carrying two panel loads and main girders of approach spans	25
All other members of main system.	15
Deck plates, transverse steel joists and stringers	25
Floorbeams, cantilevered ends of floor-beams and members of main system carrying one panel load or less	20
Members of main system carrying two panel loads and main girders of approach spans	10
All other members of main system.	5

No allowance to be added to stresses produced by the live load.

Impact shall not be added to the stresses produced by wind loads or by longitudinal and centrifugal forces.

Wind loading.

To be designed for the stresses produced by: *a*) A wind load normal to bridge of 30 lb. per square foot of the exposed surface of two trusses and one and a half times the elevation of the floor, 150 lb. per lineal foot of bridge on side walk fence (fixed load) and 30 lb. per square foot on travellers and falsework, etc., during erection; *b*) A wind load parallel with the bridge load of 30 lb. per square foot acting on one half the area assumed for normal wind pressure in paragraph *a*); *c*) A wind load (moving load) of 300 lb. per lineal foot on the exposed surface of a train applied 7 feet above base of rail.

Temperature.

To be designed for the stresses produced by : *a*) A variation of 120° Fahr. in the uniform temperature of the whole structure, normal temperature being taken as 60° Fahr.; *b*) A difference of 50° Fahr. between the temperature of steel and masonry; *c*) A difference of 25° Fahr. between the temperature of a shaded chord and the average temperature of a chord exposed to the sun; *d*) Stresses due to a difference of temperature of 25° Fahr. between the outer web exposed to the sun and the other webs of compression members.

Coefficient of expansion for steel for 1° Fahr. = 0.0000061.

Traction, brake, friction and centrifugal forces, etc.

To be computed for a total longitudinal force of 650 lb. per lineal foot for both tracks carrying traffic in the same direction.

To be computed for a brake force of 220 000 lb. for each truss assumed acting between suspended span and cantilever arm, the two end bays of lower chord of cantilever arm to be also computed for the additional forces arising from traction and longitudinal wind when the suspended span touches the stops limiting its longitudinal motion.

Torsion stresses in the suspended span from unsymmetrical loading shall be considered as primary stresses.

The tangential force produced by the rotation of a pin in its pinhole shall be

assumed as 40 % of the force on the pin. The force produced by the axial sliding of a pin in its pinhole as at the connection of the anchor arm with eyebars in masonry, and the connection of harbour arm and suspended span, shall be assumed to be 20 % of the force on the pin.

The northern approach spans to be designed to provide for the centrifugal force due to a train on each of the two tracks in the same direction running at a speed of 25 miles per hour, the force to be applied 5 feet above base of rails.

Provision to be made for the increased load carried by any member of the girders or deck due to the eccentricity of the load and to the effect of the centrifugal force.

In calculating the stresses of the anchor arm, the main pier is to be assumed both rigid and elastic, in which latter case the pier is to be assumed to resist torsion only. Modulus of torsion assumed at 1 200 000 lb. per square inch.

Erection loads.

The weight of the loaded travellers, erection plant and materials. If weights are estimated from drawings add 2 % for overrun. On all weights based on information from suppliers of machinery and tackle, add 10 % for possible overrun.

The heaviest load for each position of the travellers, etc.

50 % of the load hanging from the upper blocks of main hoist.

A wind load of 30 lb. per square foot on the exposed surface of two trusses. Considered not to co-exist.

Loading used to determine the sectional area of members.

All the co-existing loads and stresses and the deformation shall determine the section of the different members with the following restrictions :

Temperature stresses *d*) shall be considered as secondary stresses and temperature stresses due to *c*) and *d*) shall be assumed to co-exist with one quarter wind loads *a*) and *c*).

The various parts of the structure shall be proportioned for the maximum stresses produced by : 1° A combination of dead load, live load specified for railway tracks, main roadway, motor roadway and footway, impact, centrifugal force, if any, one quarter wind loads *a*) and *c*) and temperature stresses *c*) and *d*); 2° A combination of dead load, live load specified for railway tracks, one quarter live load specified for main and motor roadway, no load on footway, impact, temperature, longitudinal force and wind pressure as specified in clauses *a*) and *c*); 3° Any combination of stresses due to co-existing wind loads, longitudinal force, centrifugal force, temperature, with dead load, live load impact and all secondary stresses.

Unit stresses and proportioning of parts.

Any part of the structure built of carbon steel shall be proportioned so that the sum of the maximum stress produced by the loadings specified, including impact, shall not exceed the following amounts in pounds per square inch :

	Lb. per square inch.
Tension on net section :	
Eyebars	20 000
Riveted members	18 000
Including secondary stresses.	24 000
Compression on gross section :	
Members with l/r under 50.	14 000
Members with l/r 50 and over 50	18 000—80l/r
Including secondary stresses.	18 000
Bearing on :	
Shop rivets	22 000
Field rivets	20 000
Rollers per lineal inch, where d = diameter of roller in inches	600 d.
Pins in eyebars	22 000
Pins in riveted members . .	20 000

Bending on extreme fibres of :	Lb. per square inch.
Pins	25 000
Steel castings	16 000
Shearing on :	
Shop rivets and pins	11 000
Field rivets	10 000
Webs of plate girders, gross section	10 000
Steel castings	11 000

If nickel steel or chrome nickel steel is used, the unit stresses given above for carbon steel may be increased by 40 %, except in the tensile unit stresses which may be increased by 45 %.

From live and dead loads, wind, tractions, etc. :	Lb. per square inch.
Granite	800
Concrete, 1-1 3/4-4	500
Concrete, 1-2-5	450

Foundations :	Lb. per square foot.
Solid sandstone, dead and live loads	40 000
Solid sandstone, dead and live loads, including wind and traction, etc.	70 000
Hard shale	20 000

All parts of the steel structure shall be proportioned so that the sum of the maximum stresses during erection shall not exceed the unit stresses specified for the members of the bridge when erected, by more than 20 %. Erection unit stresses are to be used for all conditions of loading when designing the top chord eyebar supporting trusses, if eyebars are used.

For rivets with a grip greater than four diameters, reduce the units specified by 1 % for each 1/16 in. of additional grip, except in compression members having butt joints, but no rivet shall have a grip exceeding 7 1/2 diameters.

Take both systems in calculation of strains, disregarding reversal of strains.

For compression . . . 16 000—70 l/r

In calculating the laterals and cross-bracing, the axial deformation stresses arising from the lengthening and shortening of the truss members by the dead and live load stress shall be considered.

In calculating the number of rivets in the connections of laterals and cross-bracing, these axial deformation stresses shall be neglected.

Anchor piers shall have a factor of safety of two for all primary stresses including impact.

The stresses in statically indeterminate structures shall be calculated from their elastic deformations, and all assumptions made and formulæ used for the calculations must be given in stress sheets to be submitted.

All bending stresses in compression members produced by the weight of the member itself and by loads, applied on the member shall be considered as primary stresses.

All such members shall be proportioned so that the greatest fibre stress due to this bending and axial strain together will not exceed the allowed units for the axial stress in that member.

No bending stresses from weights of members shall be considered in eyebars and built tension members.

For laterals in cantilever and anchor arm, assume members fixed at both ends. For sway bracing in cantilever and anchor arms, assume members hinged at both ends for bending normal to the plane of the bracing, and fixed at both ends for bending in the plane of the bracing.

All stresses produced owing to the deformation of the steel work under any and all loads, either by the absence of pins at the joints or by the friction on pins opposing the turning of members, shall be considered as secondary stresses.

Secondary stresses due to impact to be considered.

Secondary stresses due to temperature as specified in clause *b*) and *c*) not to be considered.

Truss members subject to alternate tension and compression shall be proportioned either for : *a*) The net area obtained by dividing the tension stress by the unit tensile stress; or *b*) The net area obtained by dividing the tension stress by the unit tensile stress added to the gross area obtained by dividing the compression stress by the unit compressive stress, the unit compressive stress before dividing to be reduced by the bending stress due to the weight of member.

If in a member subject to alternate stress, $\frac{D}{T}$ is greater than 24 or 30 respectively, the area remaining after reduction on this account must be adequate for the compression and bending, and the total area must be adequate for all stresses, where D is the unsupported distance between rivet lines and T is thickness of plate.

Rivets in truss members, laterals and bracing are to be proportioned for the sum of the positive and negative stresses.

Laterals and cross-bracing shall be proportioned for the sum of the primary compression stresses in addition to the bending stresses from weight of member, and also for the sum of primary tension stresses. The larger of the two sections so determined shall be chosen. Their connections shall be designed for the sum of the primary tension stresses plus the sum of the primary compression stresses neglecting the bending stresses due to weight of member.

In designing end members and details which may be subject to alternate stresses, and laterals at the ends of the cantilever and anchor arms, the effect of traction temperature *c*), brake and friction stresses shall be taken into account together with stresses arising from dead and live load, impact and wind. The required area shall be the area obtained by dividing the sum of the stresses producing compression by the unit compressive stress minus the bending stress due to weight of member, added to the area obtained by dividing the sum of the brake and friction stresses by the unit tensile stress.

In calculating the net area of tension members, the rivet holes shall be taken 1/8 inch larger than the nominal diameter of rivets before driving.

In proportioning rivets, the diameter of the rivet before driving shall be used.

Tension members shall be given full splice in material and rivets.

All splices in compression members shall be given full strength in material and a sufficient number of rivets for the axial stress. Full area and rivets for secondary stress shall also be provided.

Pin-connected riveted tension members shall have a net section through the end pinhole at least 33 % in excess of the net section of the body of the member, and the net section back of the pinhole parallel with the axis of the member shall not be less than 80 % of the net section of the body of the member. The net section through the intermediate pin holes shall be increased over that of the member by the section cut out by the pinhole.

In no case shall the width of the built tension members be more than 15 times the thickness at the pin unless provision is made to stiffen the member behind the pin. The ends of built tension members shall be square whenever possible.

The latticing of compression members to be proportioned for a cross shear per square inch of gross section of 2 % of the unit stress for short strus of the same material; if the weight of the member produces additional shear this must also be provided for.

The compression unit stress in carbon steel for bars in single lacing shall be $8\,600 - 63\frac{L}{T}$, and in double-lacing $8\,600 - 42\frac{L}{T}$, where L = length, T = thickness. For nickel steel and chrome nickel steel increase the unit stresses by 40 %.

The unit stress in angle lacing shall not

be more than 18 000 lb. per square inch on net section of connected leg or more than 14 000 lb. per square inch on gross section of connected leg.

Double lacing shall be used for all main members of trusses. Single lacing may be used for laterals, sway bracing, and secondary members. For double lacing with rivets at intersection of bars, the length nearest end rivets shall in truss members and laterals be not more than 60 times, and in sway bracing not more than 80 times the thickness of the bar.

For single lacing in laterals and secondary truss members the length between nearest rivets shall not be more than 40 times and in sway bracing not more than 50 times the thickness of the bars; l/r for angles shall not be greater than 100 for double lacing, or greater than 67 for single lacing.

The inclination of the lattice bars and angles with the axes of the members shall be about 45° for double lattice, and 60° for single lattice.

The lattice in the main tension members shall be not less than 4 1/2 by 3/8 inch bars with separate rivets. No fillers are to be used. The l/r in these bars not to be greater than 80.

Plate girders shall be proportioned by their moment of inertia.

The gross section of the compression flange of plate girders shall not be less than the gross section of the tension flange, and the width of the flange shall not be less than one-twelfth of the distance between its side supports.

The flanges of plate girders shall be connected to the webs by a sufficient number of rivets to transmit the flange stress and those stresses produced by local loads.

Stiffeners shall be riveted to the web at all points of concentrated loads, and also, when the thickness of the web is less than one-sixtieth of the unsupported distance between flange angles, at points throughout the length of the girder, generally not further apart than the depth of web plate, with a maximum limit of 6 feet.

In spacing stiffeners, the unsupported distance, D in inches, between stiffeners shall never be greater than the value obtained from $S = 13\,500 - 45\frac{D}{T}$, where S is the web shear stress in pounds per square inch and T the thickness of the web.

Minimum radius of gyration shall be one-hundredth (1/100) of the length of member for trusses, and one, one hundred and twentieth (1/120) for lateral and sway bracing struts.

If the main part of any member of the trusses is made of nickel steel or chrome nickel steel, all the details and connections of such members shall also be nickel steel or chrome nickel steel. If the main part of any other member of the bridge is made of nickel steel or chrome nickel steel, the details and connections may be made of carbon steel.

The cross diaphragms normal to the axis of any member shall be made of the same material as the main section.

Carbon steel fillers may be used in nickel or chrome nickel steel members where these fillers carry no stress.

Details of design.

Details shall be so designed that all parts will be accessible for inspection, cleaning, painting and repairs.

Pockets or depressions which will hold water shall be provided with satisfactory drain holes, or be filled with approved waterproof material.

Main members shall be so designed that the neutral axis will be as near as practicable in the centre of section, and the neutral axes of intersecting main members of trusses shall meet at a common point.

Adjustable members shall not be allowed except for erection purposes.

The strength of all connections shall be sufficient to develop the full strength of the member, except main truss members

where the minimum section obtainable is greater than the section required, where the strength of connection shall be sufficient to develop the computed stress in the member, the kind of stress to which the member is subjected being considered.

The rivet connections for sway bracing shall be proportioned for a stress equal to 12 000 lb. per square inch for gross section of members, for cantilever and anchor arm, and for a stress equal to 14 000 lb. per square inch for gross section of member for suspended and approach spans whenever the specification calls for fewer rivets.

Bottom lateral, gusset plate, cantilever arm and anchor arm. — A width of plate not greater than 30 times the thickness between the lines of rivets connecting them to flanges, plus 15 times the thickness outside the line of rivets on either side of member, shall be used in determining the thickness of plates required to develop the section, unless the bending moments on the plates require a greater thickness. In no case shall the plates be less than 5/8 inch thick.

Web plate splices. — In truss members where web plates only are spliced and where no side plates are used, the splice material must cover the flange angles on both sides of the web. In members where plates only are spliced and where side plates are used, the splice plates need not cover the angles, but sufficient moment of inertia must be provided in splice plates, and the length of the splice plate between the angles must be at least 1 1/2 times the distance between the angles.

Gusset plates. — Gusset plates shall be examined by means of sections either curved or straight; and the assumed net section shall be able to take care of the axial stress and induced bending stress, due to eccentricity of applied force, at a unit stress not exceeding 18 000 lb. per square inch without secondary, and 21 600 lb. per square inch including secondary, for carbon steel.

No steel in deck system except fillers, handrailing and web cover plates of stringers may be less than 5/16 inch thick; the buckled plates for deck of footway and motor roadway, also the web plates of stringers for main and motor roadways and footway may be 5/16 inch thick. Any other material in deck system, also material for the floor bracing, lacings for sway and lateral bracing for the top chord, supporting trusses and for the lacing of the main tension members, may be not less than 3/8 inch thick. All other material used to be not less than 1/2 inch thick.

The nominal diameter of rivets shall be at least :

7/8 inch up to 3 1/2 inch grip;

1 inch from 3 1/2 inch to 5 1/2 inch grip;

1 1/8 inch from 5 1/2 inch grip and over.

The diameter of rivet holes shall be 1/16 inch larger than the diameter of rivet.

The actual diameter of rivets will be such as to require when heated, a slight pressure to force them into the hole. The size of rivets shall be adjusted to fill this condition.

The minimum distance between centres of rivets shall be three diameters of the rivet holes. The maximum pitch in the angles in the line of strain for members composed of plates and shapes shall be five diameters of the rivet holes. For angles with two gauge lines, the maximum sh..ll be twice the above in each line with rivets staggered.

The maximum distance between stitching rivets on the edges of tension members shall be 10 times the minimum thickness of any one of the plates connected.

The maximum distance between stitching rivets in compression members shall, with one longitudinal line of rivets, not exceed 12 times the thickness of the thin-

nest plate. With more longitudinal lines of rivets the distance in each of these lines shall not exceed 16 times the thickness of the thinnest plate, provided the distance of each rivet from each of two rivets of an adjacent line is not more than 12 times the thickness of the thinnest plate. In no case shall the distance from any one to the nearest rivet exceed 12 inches.

The minimum distance from the centre of any rivet to a rolled or planed edge shall be 1 1/2 times the diameter of the rivet hole for hand-driven rivets, and 1 3/4 times the diameter of the rivet hole for machine-driven rivets.

The maximum distance from any edge shall be eight times the minimum thickness of any one of the pieces connected, but shall not exceed 6 inches.

The pitch at the ends of built compression members shall not exceed four diameters of the rivet holes for a length equal to 1 1/2 times the depth of the member.

If riveted to truss members the holes in floor beams for the rivets connecting them to the truss members shall be drilled in such a manner that, after riveting, the end moment in floorbeams is zero under dead plus half-live load on railway and main roadway.

The thickness of plates in compression members shall not be less than one twenty-fourth of the distance between the lines of rivets connecting them to the flanges for webs of main truss members, and one thirtieth for coverplates and horizontal diaphragms, and one fortieth for the cover plates of the top chord supporting trusses, if any.

The open sides of compression members shall be provided with lattice and shall have tie plates as near each end as practicable. Tie plates shall be provided at intermediate points where the lattice is interrupted. In main members carrying calculated stress, the end tie plate shall have a length not less than the distance between the lines of rivets connecting them to the flanges, and intermediate ones not less than half the distance. Unless stiffened by angles they shall have a thickness of at least one-fiftieth the distance between rivet lines.

Tie plates shall be 1/2 inch thick in laterals, 3/8 inch thick in bracing, and they shall be stiffened by angles of the same section as the lacing, when $\frac{D}{T}$ is more than 60 (where D = distance of rivet lines connecting them to the main section and T = thickness of plate), unless thicker plates would be more economical.

The tie plates of the bottom laterals shall be at least as long as broad; those of the sway bracing at least two-thirds as long as broad. When they are stiffened by angles, these should be at intervals of about the depth of the member.

The net section of any tension flange or member shall be determined by a plane cutting the member square across at any point. The greatest number of rivets which can be cut by the plane or that come closer than the dimensions following are to be deducted from the gross section of the member.

Dimensions. Inches.	Rivets (diameter). Inches.
1 3/4	3/4 inch.
2	7/8 —
2 1/4	1 —
2 1/2	1 1/8 inches.

Abutting joints in compression members shall be faced.

Pin holes shall be reinforced by plates where necessary, and at least one plate shall be as wide as the flanges will allow, so that the allowed pressures on the pins shall not be exceeded, and so that the stresses shall be properly distributed over the full cross-section of the member. These reinforcing plates must contain enough rivets in front of two lines through the centre of pin, each under 45°, with axis of member, to transfer their proportion of the bearing pressure. They shall be at least as long from centre of

pin to end as the width of the member.

When forked ends are used they shall be made at least twice the sectional area of the member, and at least as strong as the body of the member.

Pins shall be long enough to ensure a full bearing of all parts connected upon the turned body of pin. They shall be secured by approved nuts and be provided with washers if solid nuts are used. The screw ends shall be long enough to admit of burring the ends.

Members packed on pins shall be held against lateral movement. Filling rings shall be of bent steel plate.

Provision shall be made for the expansion produced by a variation of temperature of 120° Fahr. Coefficient of expansion = 0.0000061.

Lateral, longitudinal and transverse bracing in all structures shall be composed of rigid members.

Transverse frames rigidly connected to posts and chords shall be used at each main post and at the ends of the through portion of the bridge. They shall be as deep as the clearance will allow. Other transverse frames shall be used at all points where needed.

Where flange plates are used, one cover plate of top flange shall extend the whole length of girder.

Web stiffeners shall be in pairs. Those over the end bearings shall be on fillers. The outstanding legs shall be as wide as the flange angles will allow, and they shall be brought to a close bearing against the upper and lower flange angles. Intermediate stiffeners shall be crimped over the flange angles. Their outstanding legs shall be not less than one thirtieth of the depth of the girder plus 2 inches. The thickness of all stiffeners shall not be less than 3/8 inch and the rivet pitch in them shall not be over 5 inches.

The lengths of all main truss members shall be such that, with the channel span fully loaded and the shore arms unloaded, all main panel points shall be in their geometrical positions. Deformations from impact stresses shall be neglected. A modulus of elasticity of 29 000 000 lb. per square inch shall be assumed. Proper allowance to be made for details on the compression members.

Open joints during erection will not be allowed in any part of the trusses.

The eyebars composing a member shall be parallel to the axis of the truss. In case this is found impossible, approval to use a maximum inclination for any bar not exceeding 1 inch in 16 feet must be given by the chief engineer.

All false work shall rest on concrete pedestals built on shale or rock foundations, or if allowed by the engineer, set at least 5 feet deep into the ground.

The contractor shall provide and erect between the suspended span and the cantilever arms, effective brakes to prevent motion of the suspended span under traction forces.

[621 .335 (.494)]

Single phase 4-6-2 express locomotives with independent driving axles of the « Brown Boveri » type.

Figs. 1 to 5, pp. 1478 to 1480.

(*Schweizerische Bauzeitung.*)

The majority of the electric locomotives in service on the Swiss Federal Railways are provided with coupling rods. The 4-6-2 type here described represents a locomotive, the whole design of which is based on novel principles. This is largely the result of experiments with a locomotive of the 2-6-2 type with independent axles, which gave satisfactory service for more than three years. The object has been to arrive at a form of construction which would overcome the difficulties met with coupling rods, which difficulties are due, for the most part, to the well known movements of the axles relative to the frame, and also, to a lesser degree it is true, to the relative movements in the direction of rotation between the motor and the pair of wheels. As regards the novel features of this locomotive, we reproduce from the May 1922 number of the *B. B. C.-Mitteilungen,* the following details.

Arrangement of driving wheels and carrying wheels. — Figure 1 shows the unusual unsymmetrical design. At the front, in the normal running direction, the driving wheels are preceded by a four wheeled bogie, while the rear end of the locomotive is carried by a bissel truck. The running of locomotives with a bogie leading is better than in the opposite direction with the bissel truck leading. However, for the intended maximum speed of 56 miles per hour, a single pair of carrying wheels is quite satisfactory, the more so since all the driving wheels and carrying wheels are attached to the same frame and consequently mutually assist in guiding the vehicle.

Doubtless, if the engine had two bogies it would improve its appearance, but three driving axles and three carrying axles are enough for the total weight (which is 91.5 t.) with the axle loads allowed on the Swiss Federal Railways (driving axles 20 t. and carrying axles 15 t.). The use of a second bogie in place of the bissel would not therefore offer any considerable advantage. There is also another reason in favour of the unsymmetrical arrangement. In order to keep down the weight, only one transformer is employed. This cannot be placed between the motors with the driving axles spaced as they are, and therefore it was decided to carry part of this weight upon the bogie.

A second case of lack of symmetry is that arising from the driving mechanism, that is to say, the drive between the motors and the driving axles being on one side only. In the experimental locomotive the symmetrical drive was retained, each driving wheel being provided with its own toothed wheel. The new locomotives on the other hand have three pairs of driving wheels driven on one side only, this resulting in a considerable simplification and an appreci-

Fig. 1. — 4-6-2 single phase express locomotive for the Swiss Federal Railways with independent driving wheels. (View of left hand side in the normal running direction).

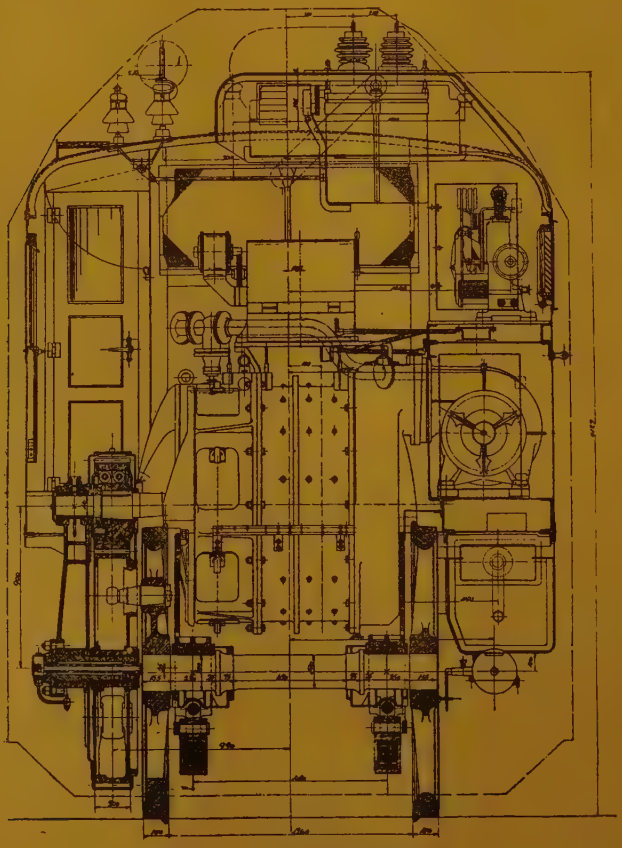


Fig. 2. — Cross section A-B.

able economy in weight. This method of driving, although universal in stationary electric plants, has not previously been employed in locomotive practice, for no other reason than that custom has adhered to the symmetrical arrangement of the steam locomotive.

Distribution of weight. — A comparison between the weights of locomotives with coupling rods and independent driving wheels with motors of equal power, is decidedly favourable to the latter in the case of high speed locomotives, that is those which are used for working express trains. The reduction in weight amounts to slightly more than one tonne per independent driving axle.

A uniform distribution of weight on the two wheels of the same axle, in the system described, is obtained by placing all the electrical apparatus on the opposite side of the locomotive to the driving gear, this novel arrangement of the apparatus on one side of the locomotive has the advantage of rendering the inspection of the electrical equipment very easy. All parts of the motors are very accessible, particularly on the side which carries the commutator. The free passage which is left enables the footplate staff to move about the locomotive. The high position of the centre of gravity of the motor, and the masses of the gearing and apparatus which are carried at the sides, give to the spring carried body of the locomotive a very large moment of inertia about its longitudinal axis (1), similar to that obtained in steam locomotives on account of the elevated position of the centre of gravity of the boiler. This property makes for steady running at high speeds. The frame with the masses overhanging at the sides and the high pitched motor constitutes as it were a stabilising or balancing device, and the designer has for this reason designated this type of locomotive as the « balanced type ».

Independent driving axles. — The cross section A-B (fig. 2) shows the construction of a motor unit, consisting of a pair of wheels, a pair of gear wheels, a motor and ventilator, and figures 3, 4 and 5 show the arrangement of the gear wheels and their connections. By placing the gear outside the driving wheels, the aim has been to reserve the space between the tyres (or between the frame plates) for the development of the motor, and to retain liberty to fix the size of the gear wheel, since there is more than ample space between the driving wheels and the loading gauge. In order to obtain a suitable gear reduction, the axis of the large toothed wheel is situated above that of the driving wheels. The toothed wheels and driving wheels are connected by means of a special coupling which is flexible in every direction (fig. 4) and which allows the position of the driving axle relative to the engine frames to be displaced without restraint, both vertically and transversely, as may be necessary when the wheels enter a curve. Thus, with this coupling a locomotive can be constructed having a rigid frame and with an exceptionally large driving wheel base, or if desired, make one of the bogie axles a driving axle. Another property of this coupling is that, in spite of the eccentric position of the toothed wheel, the rotational movement of the latter is transmitted with the same angular velocity to the corresponding pair of wheels. We may refer in this connection to the « analytical considerations » of Messrs. Buchli and Couvenhowen, which are appended to the article published in the *B. B. C.-Mitteilungen*, but which we have not space to reproduce here.

The toothed wheels are of liberal dimensions, thus the pinion has been made

(1) This is the longitudinal axis of the locomotive about which the spring carried portion can oscillate. It is situated a little above the level of the carrying springs.

of sufficiently large diameter so that springs can be inserted between the boss and the rim, in order to give flexibility to the drive. If the power developed by the motor were to demand it, the width of the teeth could be increased, whereas in the internal geared type this could only be done at the expense of the

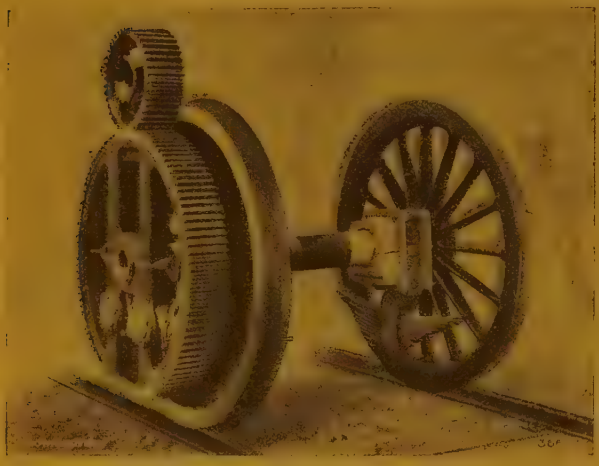


Fig. 3. — Pair of wheels.

Fig. 4. — Gear, with universally flexible coupling between the driving wheel and toothed wheel.

LEGEND :

A = Driving pin fixed in the driving wheel and projecting through the inner wall of the body of the toothed wheel.
B = Connecting links.
C = Ball and socket joint of the connecting levers.
D = Fulcrum of the coupling levers, fixed in the body of the toothed wheel.
S = Toothed sectors of the connecting levers.
R = Pinion.
T = Driving wheel.
Z = Toothed wheel.

Fig. 5. — Casing of toothed wheel with oil pump mounted at its centre.

Fig. 3 to 5.

width of the motor. The pinion is also mounted on a spherical seating which ensures a perfect engagement between the teeth and has given excellent results. This spherical seating corrects the slight inaccuracies which may arise in erecting the motor, and ensures an exact relative position of the gear wheels.

The stresses put upon the driving axle boxes and upon the frames are much

less with the independent axles than with the coupling rod arrangement. There is no reversal of thrust during a revolution of the wheel, and play, in the bearings which must sooner or later appear, does not exert any effect detrimental to the running of the locomotive. Special devices for taking up play therefore become unnecessary, and the frames may be of lighter construction. These advantages lessen maintenance to a considerable extent.

Drive between the toothed wheel and driving wheel. — The construction of this drive is extremely simple. As will be seen from figure 4, an absolutely free relative movement between the gear wheel and driving wheel is provided for. This flexibility of drive, which allows the frame to move relatively to the wheels, is worthy of special attention, for up to the present there have been very few types of drive which have possessed this property.

The drive consists of a system of levers placed within the toothed wheel. The pins AA, which are fixed in the driving wheel T, carry connecting links BB, the other ends of which are forked to connect with ball and socket joints at the extremities of two levers C-S which carry toothed sectors S. The pins AA project through the inside wall of the body of the toothed wheel and are connected to the latter by means of links B and lever C-S which turn about axes DD. The pins AA have also a ball and socket joint so as to ensure freedom of movement between the driving wheel and the toothed wheel within the limits necessary for running conditions. The toothed wheel turns on a pivot with a conical bearing. This method of mounting the toothed wheel is a new departure, but it may be employed without any hesitation, since there are no forces which tend to cause the toothed wheel to take up a position oblique to its axis, and lead to an unequal wear of the bearing.

Owing to this great flexibility, this method of driving allows tyres of different thicknesses to be used for the pairs of wheels on the same locomotive. Therefore in the case of an unequal wear of the tyres it is not necessary to remove and turn all the pairs of wheels of a locomotive, as is necessary where the drive is by means of coupling rods. The freedom of access to the drive and the removable covers of the casing offer considerable advantages from a running shed point of view.

We may here mention another favourable property of this drive which is of special importance in actual service. It is sometimes necessary to be able to uncouple the toothed wheel from the driving wheel when out on the line far from depots or workshops, when any failure occurs to a motor or toothed wheel. To do this, the two pins AA, which are the only connection between the toothed wheel and the driving wheel, may be removed without difficulty.

Special attention has been given to the lubrication of the gear wheels and driving mechanism. A plunger pump (fig. 5) driven from the large toothed wheel pumps oil from a sump to all the parts of the driving mechanism which require lubrication. After having lubricated these, it again drains to the sumps, where it is passed through filters and then again returned by the pumps. The lubrication is entirely automatic, the only attention needed on the part of the staff being to periodically fill up the oil reservoirs.

Arrangement of bearings of rotor shafts of the motors. — Contrary to usual practice, the rotor shaft is supported at three points. In addition to the bearings of the motor there is a third bearing outside the pinion (see section A-B, fig. 2), so that this is supported on either side. There is considerable advantage in this arrangement. The correct engagement of the teeth is well

assured from the fact that the exterior bearing which carries the pinion and the pin on which the large toothed wheel turns are connected to a common support which forms part of the frame. With independent axles, the frames of the locomotive can be well stiffened, whilst there is no ground for apprehension that, on account of deformations of the frames which are inevitable in service, binding will take place in the bearings of the large toothed wheel and of the pinion, as is shown to be the case in practice even after years service.

Springing of the locomotive frame. — The springs of the driving wheels are connected by equalising beams to ensure the equal distribution of the load. The whole of the spring borne mass of the locomotive is thus supported at three points on its longitudinal axis. The static reactions are thus indeterminate, and the necessary provisions are made to ensure that undulations in the track do not cause very great variations in the reactions at the three points of support. In order to keep these variations within reasonable limits, the carrying axles are provided with a double suspension system, by plate springs and also by coil springs arranged in line.

Power of the locomotive. — The use of independent driving wheels allows a large amount of power to be applied per axle. A motor of the 4-6-2 locomotive described above will develop, for one hour, 700 H. P. at a speed of 500 revolutions per minute, whilst there is plenty of available space for accommodating even larger motors without difficulty. The total power of the 4-6-2 locomotive, developed for one hour, is 2 100 H. P. It will haul a load of 480 t. up a gradient of 1 in 100 at a speed of 40.5 miles per hour. It will haul the same load down a gradient of 1 in 500 at a speed of 56 miles per hour. During the tests to determine the loads which could be taken, the locomotive started from rest and accelerated without any difficulty a train of 120 axles having a total weight of 722 t. on a rising gradient of 1 in 100, developing a drawbar tractive effort of 12 t.

For axle loads not exceeding 20 t., which is the maximum for European railways, there is no need to provide for a greater power per axle than that mentioned above. If one were building a locomotive for American railways, one might, in adopting the system of independent axles, find room for and utilise powers as high as 1 000 H. P. in each separate motor.

Sphere of utility of the independent driving axle system. — The independent driving axle arrangement is essentially a method of construction suitable for working fast trains, that is, for high speed locomotives which develop a high power per axle. This is not a reason against its employment for freight service, in that it would be a mistake to decide to employ it exclusively for one form of service. There is no difficulty from a constructional point of view which would militate against its use for freight service, but since as a rule freight locomotives have a larger number of driving wheels than express locomotives, and since the power developed per pair of wheels is less, it is certainly advantageous to couple several driving wheels and drive them from a common motor.

Results obtained in service. — The experimental 2-6-2 locomotive has now been in service for more than three years. The anticipated advantages of its arrangement of drive have been fully realised. Up to the present none of the bearings of this engine have been replaced or refitted, and none of the tyres have been re-turned. Moreover, the driving mechanism has not shown the least trace of wear.

Of the eight express locomotives of the

« balanced type » ordered by the Swiss Federal Railways as a result of these excellent results, six have been delivered up to the present, the first of these having been in service since September 1921. The mechanical parts of these locomotives have been made in the shops of the Swiss Locomotive and Engine Works at Winterthur. They are intended for hauling heavy express trains and are now in regular service between Berne and Thun (1). As far as can be judged at present, these engines show a superiority over all the locomotives with coupling rods employed by the Swiss Federal Railways, both from the point of view of maintenance costs, and also as regards easy access to the various parts. These locomotives run remarkably steadily at all speeds, but especially at high speeds, since lateral shocks only act on the mass of the wheels, without exerting any influence on the engine frame.

An objection which is sometimes raised against the independent driving wheel system is that it has a greater tendency to slipping than the type in which the wheels are coupled, and cannot as fully utilise the adhesion.

Practically speaking this is equivalent to stating that a locomotive with coupling rods can give a greater tractive effort than a similar locomotive with independent axles. However, the results obtained in service up to the present, and especially the slipping tests carried out in order to determine this point, have completely removed all doubts on this point.

Independent driving wheels, provided that suitable provision is made to ensure that they are loaded uniformly, do not show a greater tendency to slip than do wheels which are mechanically coupled. It is on account of this experimentally determined fact that all the devices fitted to the 4-6-2 locomotive to automatically ensure that the three motors should make an equal number of revolutions (which is equivalent to electrically coupling the motors) have been abandoned as unnecessary. Slipping, which has been artificially produced at different speeds and with different conditions of the rails, has shown that all the pairs of wheels lose their adhesion practically simultaneously. The high tractive effort developed by the 4-6-2 locomotives has been surprisingly satisfactory.

Attention has also been drawn to the danger arising from the gyroscopic effect of the rotors when traversing a curve at high speed. In itself this effect is unimportant at the speeds attained in practice. However, in the Brown Boveri system of independent driving wheels with a simple pair of gear wheels, the direction of rotation of the wheels of the locomotive is opposed to that of the rotor of the motor, and the gyroscopic effect on the locomotive is still further reduced from the fact that the effect of the wheels (though less it is true both as regards mass and number of revolutions) is opposed to that of the rotor.

(1) Since the middle of March, locomotive No. 10304 has been employed on express service on the Gothard line.

MISCELLANEOUS INFORMATION

[625 .111]

1. — Reverse studies detect errors in railroad location,

By C. K. CONARD, Northport, N. Y.

(*Engineering News-Record.*)

The necessity for studies of railroad locations from opposite directions, as set forth by A. M. Wellington, has been so forcibly impressed on the writer, that in going over country on location work he finds himself subject to an irresistible desire to keep looking back for possible variants that might improve the line. Even after a location has been made, it is advisable to make studies between the several controlling points, to make sure that the line selected is the most economical.

The following actual incidents illustrate the advantages to be obtained by studying stretches of line from both directions. Some years ago the writer was in charge of surveys for a low-grade freight line that the Erie Railroad comtemplated building in Orange Co., New York. The work had proceeded to the point at which projections were being made from the field maps. Just north of Middletown a crossing of the New York Ontario & Western Railroad held up the grade line in the middle of the 12-mile descend from the Otisville tunnel to the Wallkill River.

The crossing was located at a sag on the Ontario & Western Railroad, where marshy land prevented any lowering of their roadbed. The resulting fill for the Erie line amounted to some three hundred thousand cubic yards. Furthermore, the alignment just west of the crossing was bad. In studying this situation our information was that there was no other feasible crossing of the Ontario & Western Railroad in the vinicity and the profile seemed to bear this out. It looked like a case of accepting a bad situation.

Before doing this, however, a last effort was made. Together with an assistant, each of us carrying a compass, hand level, and aneroid barometer, the writer started out to find some point where the Ontario & Western Railroad could be crossed underneath, instead of overhead. Just north of Middletown yard limit the Ontario & Western Railroad starts down grade towards the meadows and the projected crossing. Taking the first culvert as a starting point, although the fill was only about six feet, we easily determined that our location could pass underneath, from the down-grade side. Then, striking across country to the west, and plotting a profile from estimated distances and aneroid elevations, we traversed a line that on being developed proved to be about $200 000 cheaper and a whole mile shorter than the first.

The failure to cover this line previously had come about through following a hillside in working down-grade instead of cutting across a ridge. Viewed from the up-grade side of the ridge it certainly seemed the natural thing to do, and only by working in the opposite direction was the mistake discovered. In this particular case the remedy was so simple that it was embarrassing. It was difficult to explain why the mistake had not been discovered earlier. And when you begin to explain, you are damned.

A more recent case occured in Central America. A railroad 120 miles long, had been located, and partly constructed, some ten or twelve years ago. The original location was made running from west to east. In relocating the line a party was started at the eastern terminus, and followed the old grading. At

kilometer 8 a ridge was crossed, a 3 % grade being used to overcome the 140 m. of rise. As we were using 2 % for our maximum grade, some development was necessary. It proved impossible to use the old summit cut, although the grading was 75 % completed.

Although the distances involved were comparatively short, the heavy undergrowth of the tropics made it impossible to get a general idea of the lay of country without actually running lines. In this instance stadia was used for distance and vertical angles for elevations. Leaving the spur that carried the old line well out into the swamp land, we struck out on a fairly straight line along the foot of the ridge. Every stream that crossed the line was investigated to its saddle or high enough to prove that it was impracticable.

Eventually, at the end of the second day, a summit was found that promised well, and a transit line and levels were run. The notes, as platted, showed that we were close to the old grading on the west side of the ridge, with a fairly easy side-hill descent from the summit. The projected location on this variant was more than a kilometer shorter; the summit more than 10 m. lower; the maximum grade was 2 % instead of 3 %, the curvature was reduced one-half, and the grading quantities were less than on the old line. Altogether the old line was a good example of « letting it go at that ». Had the construction work been completed, and the line opened for traffic, this mistake would have been discovered as soon as the forest was cleared away. The really surprising part of this discovery was that the new summit cut was towards rising ground from the old summit, and the investigation in that direction was undertaken without the slightest hope of finding anything worth while. We simply expected to make sure that it was impracticable.

As for following out this principle on projection work, there are many conflicting ideas. The writer prefers to project lines from the summits downgrade, on the idea that any necessary development for distance can better be made on low-lands, where valleys tend to be broader, and where there is usually more latitude in placing the line. At summits the line is fairly well fixed. But even so, no line should be accepted without some study of the possibilities of working upgrade.

Nothing is so indicative of inexperience as a set of expensive field maps, on which a single line shows the projected-location study. While it is true that because of map errors the first location run out on the ground in hilly country is seldom the line constructed, the final line should be a refinement of the projected location, and not a new line. Experience only, will give the judgment necessary to say just how far to go in refining a projected line, but it is well to go on the principle of never being entirely satisfied with the line laid down.

The lamentable failure not only in this country, but all over the world, to continue the laying out of new railroads, during the past eight or ten years, has caused a gradual elimination of men expert in location work. Should a period of prosperity, with a changed public opinion, permit a continuation of the railroad program, it is probable that the young men employed on that work would be lacking in practical experience. Without such safeguards as those outlined above, we should have many failures in properly laying out the work.

[656 .257]

2. — Long distance operation of facing points.

Figs. 1 to 4, p. 1487.

(*Railway Engineer.*)

Some time ago the Ashington Colliery Company, of Ashington, Northumberland, converted its single line between Ashington No. 1 and No. 2 boxes into a double line. At No. 2 box

is a junction where the line to the left continues as a double line towards Linton, and the line to the right as a single line towards Ellington. The junction with the Ellington single line is of the modern type, *i.e.*, a double line junction converging into a single line. The single line points are, however, 500 yards from the signal-box : too far to be worked therefrom mechanically and too often used to be actuated from a ground frame. Both these difficulties have been overcome by working the points electrically from the signal-box. Although passenger trains run at frequent intervals over these lines they do not convey paying passengers, being all connected directly or indirectly with the Ashington Colliery. The lines are not therefore open for public traffic, and thus not subject to the control of the Ministry of Transport. The Requirements as to New Railways consequently do not apply, but even if they did what has been done is permissible, as in the revised instructions shortly to be issued there is, we understand, no limit laid down as to the distance for power-operated points. What we are about to describe is, therefore, of interest because of the developments possible from the long-distance operation of points, especially as the distance is no object; because they are worked by power generated from primary batteries and therefore independent of any electric power supply, and because this is the first such installation we have in Great-Britain.

Equipment in signal-box.

Ashington No. 2 signal-box contains 27 levers, of which one is spare, and a gate wheel. The single line points in question are worked by lever No. 7. The signal for coming off the single line is No. 5, and the starting signal for leading on to the single line is No. 23. In the lower part of the box there is fixed to the apparatus timber a six-way contact box, by the right side of which is a crank coupled by rod to No. 7 lever. A 10-volt battery of 16 Edison caustic soda cells is also provided, and connected to one side of the circuit breaker.

An outward and a return line wire are run from the contact box through a track relay at the points to a polarised relay, also at the points, and each wire has a normal and a reverse contact, and thereby, in accordance with the position of the lever, current flows from the battery in the signal-box in the normal or reverse direction. The two other contacts are for working the normal and reverse check locks on the movement of the lever and preventing the stroke of the lever being completed until the points correctly lie and are bolted in their new position.

The lever is first moved two-thirds from normal to shift the points. This is as far as, owing to the check lock, it can be, and is held there waiting for the check lock to be actuated and the lever released for its reverse movement to be completed. It will thus be seen that this beneficial refinement of power signalling is possible in a low-voltage machine. Two indicators are provided between the block instrument and the block bell. The left of these is a continuous indicator for showing the position of the points. It has three indications : Normal, reverse, and wrong; the last is shown during the movement of the points or should they be accidentally or maliciously displaced. The right indicator is coupled to the track-circuit at the points.

Lay-out at the points.

Figure 1 gives a good idea of the general surroundings. In the foreground are the single points in question, and it will be appreciated that independently of their being 500 yards from the box the curvature would have militated against satisfactory mechanical operation from the signal-box. The home signal from Ellington is about 130 yards in the rear of the points, and track-circuit is laid in thence to the fouling points on both lines of the double line. The track relay connected thereto is, as has been said, in the circuit to and from the polarised relay at the points, and thus when any train or vehicle is in their immediate vicinity the point mechanism cannot receive current for operation. The track-circuit serves a further purpose — it tells the signalman, by means of the right-hand indicator already referred to, when an approaching train has

Fig. 1. — General view of No. 7 points

Fig. 2. — Point lay-out.

Fig. 3. — Derailer on the rail.

Fig. 4. — 20-volt battery for operating track relay and polarised relay for point machine.

passed clear of the fouling point and when a departing train is wholly on the single line.

A derailer is provided near the starting signal on the down road. This works, by the rodding seen on the right, with the points. When the points are reversed and the road lies for a train to pass on to the single line, as in the position seen in figure 1, the derailer is off the line.

Point mechanism.

Figure 2 is a nearer view of the point mechanism which is a development of the high-voltage machine which is a characteristic feature of the successful all-electric installation put in by the same signalling firm at Baker Street, Metropolitan Railway. In his paper, « All-electric Automatic Power Signalling on the Metropolitan Railway », read before the Institution of Civil Engineers on 21 March last, Mr. W. Willox, the late chief engineer of that company, said : « These point machines have been in use since January 1913, and have been so scientifically and strongly constructed that the pinions on the motors and in the various parts of the machine are still practically as good as when originally put in, and no failures have arisen although several of them have shifted the points over 500 000 times. » It consists of an electric motor, driving, through a chain of gears, a drum having cam paths in which are two rollers. One roller is attached to a crank coupled to the operating rod attached to the switches of the points, to which rod is also attached the rodding to the derailer, whilst the other roller is connected to the crank, seen above the motor mechanism, which is attached to a rocking shaft for the purpose of operating the plunger of the facing point lock. No locking bar, owing to the use of track-circuit, is provided.

The cam paths are so arranged that the following sequence is obtained : 1° locking bar, were one provided, raised to its highest position; 2° plunger, if bar had been raised, withdrawn; 3° switches, now unbolted, moved to their new position; 4° points, in their new position, bolted; 5° movement of locking bar completed.

In the foreground on the right is seen in the « four-foot » a switch box in which are circuit breakers operated by rods attached to the nose of each switch. The plunger as it enters either of the two slots in the stretcher bar also makes a contact that indicates that its work is done. There is also a switch box at the derailer : on the right in figure 3. From the battery at the points and through the first-mentioned switch box and that at the derailer are run the two wires to the two other contacts in the six-way contact box mentioned above, over which current passes to actuate the check locks on No. 7 lever. These ensure that after that lever has been pulled about two-thirds of its movement from normal to reverse the points must lie for a train to pass on to the single line and be bolted and that the derailer is off the rail, before the remaining third of the stroke can be completed. Similarly, when the lever is pushed from reverse to normal it is stopped when two-thirds over until the check lock is released, indicating that the points lie, and are bolted, for the arriving road and the derailer is on the outgoing line (fig. 3).

A third wire from the point mechanism forms a return. The three-position indicator is permanently connected to the three lines. It therefore gives a continuous indication of the position of the points.

Power supply and current required

All the power equipment required is seen in figure 4, which also illustrates the case carrying, in its upper part, the polarised point control relay, and, in the lower, the track relay. The 20-volt battery consists of 32 Edison caustic soda cells. About 3 amperes are required to start the machine but after the movement of the points and derailer is commenced 2 amperes is sufficient. The time of operation is about 18 s.

Derailers.

It may be noted that at No. 2 box there are three, and at No. 1 box two, of the derailers which have been successfully used in substitu-

tion of safety points at Liverpool Street (Great Eastern Railway) and elsewhere. Locking bars are provided to guard against their premature replacement on to the rail.

[625 .144.4]

3. — Power tools expedite maintenance work on railroads overseas.

Figs. 5 to 7, p. 1490.

(*Railway Maintenance Engineer.*)

Progress in the use of mechanical equipment in track maintenance work in England and France was reviewed in an article by N. M. Clougher before a meeting of The Permanent Way Institution in London, which gives an interesting insight into the character of equipment which has been developed and used, and the nature of the results secured.

Current practice in England and France seems to favor electrical equipment with semi-portable power units. In some cases these are small gas engine generator sets, in other cases steam has been used. One marked departure from American practice is the custom of setting up a temporary trolley wire so that the various power units may be supplied with current by means of a trolley pole which is hung on the wire where needed. The smaller generator outfits are rolled over the tracks on their own wheels and are set off the tracks according to methods employed with similar equipment in this country.

Power operating machines have been used to some extent for tamping ties, boring screw spike holes, turning the screw spikes in and out, for adzing ties and for sawing and drilling rails. One essential difference between these machines and those used thus far in America is that the machines are of such size that they cannot be carried or handled by the operators. Instead they are mounted on small trucks in such a way that the weight of the machine is supported on wheels. The trucks provided for this purpose, however, are made so that they may be taken off the track in about a minute.

The tamping of ties with the electrical tamper has proven successful in various classes of ballast, including slag, stone and (during the war period) even with mine earth. Attention, however, is called to the necessity of using a shoe on the tampers adapted to each kind of ballast. These electrical tampers will deliver 400 blows a minute. The machines are ordinarily operated in groups of four, one on each side at each end of the tie, and these four machines will tamp from 40 to 60 ties thoroughly per hour, or 10 to 15 ties per man hour. However, with this performance it is not fair to make a comparison with hand tamping because the mechanical tamping is much more thoroughly done. The advantage of this tamping as given by the author of the paper is summarized as follows :

1° The ballast is tamped more firmly and uniformly than is possible by hand;

2° It is necessary to go over the track only once, instead of having to come back several times after settling. This in itself is a great saving;

3° The track seldom settles after tamping;

4° Normal train speeds may be resumed immediately after the tamping is completed;

5° The tamping battery can immediately follow the relaying gang, and so the track is completely finished at one time;

6° There is greater security on curves and generally an increase of public safety;

7° The tampers have shoes specially designed for each kind of ballast;

8° As the man does not take the weight of the machine he can feel to a nicety when the tie is fully tamped;

9° Similarly he can direct the blow where required with great precision;

10° As the tamping is finished before the passage of a train the tie is not injured by being crushed on to a few sharp points of stone that frequently suffice to support it in the case of hand-tamping;

11° Under proper conditions this is cheaper than by hand-tamping.

Fig. 5. — The machines are mounted on little cars.

Fig. 6. — Mechanical tamping in the Orient.

Fig. 7. — Boring ties in the yard.

The extended use of screw spikes in Europe for holding rails to the ties lends considerable importance to machines for boring holes and screwing down the spikes. In the case of the screwing machine, the most important consideration, and one which gave trouble for a considerable time, was to avoid carrying the work too far, in other words, over tightening so that the threads formed in the wood are stripped. This has been overcome by tests which determined a maximum twist which the wood fibers can withstand, and then providing the machine with an adjustment such that the power will be shut off at some limiting torsional moment set at a safe margin below the ultimate strength of the wood. In spite of this restriction or complication, the operation of the machine is very rapid. They are also used for removing the screws from the tracks, for which purpose the machines will readily remove 10 screws per minute.

Machines are also used for boring the ties for screw spikes. Sometimes this work is done at yards and at other times the machine is moved over the line on a small car for use where needed. The work of boring is also done very quickly in spite of the fact that the holes have to be set for gage with a template. Work of this kind has frequently been done at a rate of 6 000 holes per day for each machine. This, however, is on the basis of six holes per tie which, of course, is decidedly unlike American practice.

Considerable success has also been had with an adzing machine, consisting of high speed milling cutters operated by an electric motor much like American practice for the same purpose. The paper placed particular stress on experience with this machine in France in the re-adzing of ties in service, both ends of the tie being adzed at one time without removing it from the track. The operation requires only from 5 to 10 s. and can be made to give almost any type of cut desired. On new ties this machine will turn out from 1 000 to 2 000 ties per day, this production being decreased on old ties in which considerable sand and stone has become imbedded.

The rail drill, like the other machines, is electrically operated, a motor of the required power being supplied with current from an electric generating set. The machine is carried on a light car, but in this case only one machine is provided, which is set on a pivot at the center, so that either rail may be drilled as required. The drill works at 200 r. p. m. and drills a rail in about 30 s. In actual practice the output is about 40 holes per hour, or about one every 1 1/2 m., the extra time being taken up in moving the machine, etc. The value is not alone in drilling holes for splice bolts, as it has a very important use in drilling holes for bonding rails.

The need of a new type of rail saw became apparent during the late war, and as a result a readily movable power driven rail saw was introduced for use along the line, and this has met with considerable success. Blades of the hack-saw type are used, and a rail is cut in from 6 to 10 m., leaving a square and clean cut face.

Another development which apparently has no counterpart in this country is a device for loosening ballast that has become thoroughly consolidated. Unfortunately the paper goes into no detail as to the character of this machine, but states that it loosens the ballast very quickly.

OBITUARY

Dr ROBERT WINKLER,

Late technical director of the Federal Post and Railway Department of Switzerland;
Second vice-president of the Local Organising Committee of the eighth session (Berne 1910);
Late member of the Permanent Commission of the International Railway Congress Association.

In the May-June 1922 number of our *Bulletin* we announced that owing to failing health our colleague of the Permanent Commission, Mr. Robert Winkler, had resigned his duties as technical director of the Swiss Federal Department of Post and Railways, and we expressed our hope for his early recovery.

This hope, however, unfortunately has not been realised, Mr. Winkler being taken away from his family and friends on 25 August last.

He took a very lively interest in our Association. As vice-president of the Local Organising Committee of the Congress at Berne in 1910, he contributed greatly to the success of the session, and all those who came in contact with him on this occasion recall how cordially and kindly he received them.

Mr. Winkler was nominated as a member of the Permanent Commission at the meeting held at the end of the Berne session, and since that time he has never ceased to take a very active part in the work of this Commission, and to give manifold proofs of his great devotion to our Institution.

Born at Lucerne on 12 September 1861, Dr. Robert Winkler was brought up in the primary schools of his native city, and afterwards attended the higher professional school of the canton, becoming head of the school in 1879 and leaving with the highest diploma.

As a student of the Federal High Technical School of Zurich he obtained in 1883 the diploma of Engineering of Bridges and Roads.

He was then successively engaged on the work of the quays at Zurich; the hydraulic installations in Alsace and in different towns on the Rhine, and in the construc-

tion of the St. Gothard Railway to Bellinzona and to Lucerne, being afterwards engaged on the water supplies to Milan, Laibach and Belgrade.

On 1 January 1889, he definitely entered the railway service as manager of the Pilatus Railway, which had just been constructed, and for twelve years he had charge of the technical and commercial management of that line to which he devoted both talent and energy.

The most important part of his life, however, began in 1901 when he became director of the Technical Department of the Swiss Federal Railway Department. He had to solve all manner of technical problems in connection with railway construction and operation, and not only had he to deal with the drawing up of legal regulations, but in his capacity as an official of a Federation Control, was also concerned in carrying out the same.

During the twenty years Robert Winkler was at the head of the Technical Department of the Swiss Railway Department, he showed much tact, kindness and intelligence, great technical ability and had the happy knack of being able to reconcile interests which had been at variance. It can be said without exaggeration that, thanks to his activity in the Railway Department, Switzerland fulfilled in a singularly happy manner its position as a bond of union between the great powers of Europe.

Our deceased friend was very highly esteemed, not only on the railway system of his native country, but far beyond its frontiers, in fact his reputation became established throughout Europe.

With regard to International work, Mr. Winkler represented the Federal Council at the annual Time Table Conferences from 1902 tot 1916. He was also then the representative on the European Time Table Conferences 1920 to 1921 at Berne. In 1907 he presided at the International Conference for railway standardisation; in 1909 he attended the International Railway Commission on automatic brakes for goods trains; in 1912 the Austrian Hardy brake trials, and in 1913 those of the Hungarian Westinghouse brake for goods trains; in 1910 at Brussels and 1912 at Christiania he represented the Federal Council in the International Congress of secondary railways; and in 1911-1912 he was president of the International Commission entrusted with reporting upon the standard loading gauge for goods wagons, etc.

From 1904 to 1916 Robert Winkler represented the Railway Department in the Swiss Committee of investigation on electric traction; in 1909 he was offered a seat in the general direction of the arrondissement, and in 1911, in succession to Mr. Flury, in the general direction of the Swiss Federal Railways. Mr. Winkler declined these offers, preferring to keep to the post of technical director of the Railway Department. This in itself is sufficient to show how devoted he was to the State.

Mr. Winkler was president from 1898 to 1914 of the Association of the old pupils of the Federal High Technical School at Zurich, and was president from 1917 to 1921 of the Society of Engineers and Architects of Switzerland.

In 1921 he assisted at the ceremony of the laying of the final stone of the second Simplon tunnel, a work to which he had devoted part of his time. He, however, about that time began to fail in health, but that did not prevent his proceeding contrary to medical advice, to enter the tunnel along with the Italian officials in order to measure its length. He was a man devoted to duty and he could not refrain

from fulfilling that duty as long as he had strength to do so.

On 31 May last he took leave of the staff, and in thanking them for the ever ready devotion shown towards him he ended by saying : « I sincerely trust that you and yours may have every happiness, and at the same time I also trust that you will retain the tenderest memories of the manager who is now leaving you. »

We offer the family of our dear and regretted old friend the expression of our sincerest condolences.

The Executive Committee.

NEW BOOKS AND PUBLICATIONS

[656 .256. (09.3 (.73] & 385. (04)]

AMERICAN RAILWAY ASSOCIATION (Signal Section). — **The invention of the track-circuit.** — One volume 8vo (9 1/2 × 6 1/2 inches) of VIII + 114 pages with 31 figures in the text. — 1922, New York, Signal Section, American Railway Association.

This work has been published in memory of William Robinson, the inventor of the track-circuit system, on the occasion of the Jubilee of his taking out the first patent on 20 August, 1872. It is edited by a Committee nominated by the Signal Section of the American Railway Association at its meeting in June 1921 shortly after the death of Mr. W. Robinson, which took place at Brooklyn on 2 January 1921.

Track circuiting is today one of those inventions for providing protection for trains from the rear, and is adopted throughout America. The objects of the writers of this book, however, have not only been to prepare an appreciative reference, but to demonstrate the efficacy of the apparatus in practice, and they have only needed to point out that since January 1921 more than 56 000 miles of line in the United States have been fitted with the automatic block by track circuiting, whilst about 60 000 relays are now at work day and night to ensure the safety of both passenger and goods trains.

The work is divided into four parts. The object of the first part is to accord the necessary praise to Mr. Robinson, and to point out his numerous inventions. The second refers to the life of Mr. William A. Baldwin, general superintendent of the Philadelphia & Erie Railway, — which is now absorbed in the Pennsylvania System, — who was the first to appreciate Robinson's idea, and afford him means of putting it to the test. He was also responsible for the first installations of automatic block signals controlled by track circuits.

The third part of the work gives a description of the track-circuit and its use, and recounts the chief improvements that have been made to modernise the apparatus.

The fourth part, edited by Mr. Lascelles of London, gives account of track circuiting in various parts of Europe.

The work has been produced with great care and contains a striking photograph of Mr. W. Robinson, who was born in Ireland in 1840. It will be of absorbing interest to all who study the history of inventions connected with railways.

J. V.

Monthly Bibliography of Railways [1]

PUBLISHED UNDER THE SUPERVISION OF

J. VERDEYEN,

Secretary of the Permanent Commission of the International Railway Association.

[016 .385. (02]

I. — BOOKS.

In French.

1921 385 .581 (.494)

CONSEIL FEDERAL SUISSE.

Ordonnances nos 1 et 2 pour l'exécution de la loi fédérale concernant la durée du travail dans l'exploitation des chemins de fer et autres entreprises de transport de communications. (Du 12 août 1921.)

Berne. In-8°, 17 et 19 pages.

In German.

1921 621 .8 (02

BETHMANN, Ing.

Die Hebezeuge. Berechnung und Konstruktion der Einzelteile, Flaschenzüge, Winden und Krane.

Braunschweig, Friedr. Vieweg & Sohn, 5. Aufl., 614 Seiten mit 1 168 Abb. (Preis, geh.: 85 Mark.)

1921 62. (02

CORNELIUS. Eisenbahnochbauten.

Handbibliothek für Bauingenieure. II. Teil, Band 6. Berlin, Verlag von Julius Springer. (Preis: 22 Mark.)

1921 621 .9 (02

MAYER (Hermann), Prof. Dipl. Ing.

Leitfaden der Werkzeugmaschinenkunde.

Berlin, Verlag von Julius Springer, 2. Auflage mit 330 Textfiguren. (Preis: 28.50 Mark.)

1921 624. (02

MELAN (J.), Dr. Ing. e. h.

Der Brückenbau. III. Band : 1 Hälfte : Eiserne Brücken, I. Teil.

Leipzig und Wien, Franz Deuticke, 456 Seiten mit 417 Abb. (Preis, geh.: 120 Mark.)

1921 656 .25 (02

ROUDOLF (Oskar).

Die Sicherungswerke im Eisenbahnbetriebe. Ein Lehr- und Nachschlagebuch für Eisenbahnbetriebsbeamte und Studierende des Eisenbahnbaufaches. Erster Band : Elektrische Telegraphen, Fernsprechanlagen, Läutewerke, Kontaktapparate, Blockeinrichtungen.

Berlin und Wiesbaden, C. W. Kreidels Verlag. Mit 404 Textabbildungen. (Preis, gebunden : 60 Mark.)

1921 621 .9 (02

WILDA (H.), Prof.

Die Werkzeugmaschinen für Metallbearbeitung. Band II. Die Bohr- und Schleifmaschinen. — Die Herstellung von Zahnrädern auf Werkzeugmaschinen.

Berlin und Leipzig, Vereinigung wissenschaftlicher Verleger, 96 Seiten mit 128 Abbildungen. (Preis : 4.20 Mark.)

In English.

1921 625 .1 (06 (.73)

AMERICAN RAILWAY ENGINEERING ASSOCIATION.

Proceedings of the American Railway Engineering Association.

Chicago, published by the Association, Manhattan building (6×9 inches), 1 092 pages, illustrated.

1921 62. (01 (.73)

AMERICAN SOCIETY FOR TESTING MATERIALS.

Standards of the American Society for testing materials for 1921. Issued triennially.

Philadelphia, Pa., published by the Society, 1315, Spruce street (6 ×9 inches), 890 pages, bound in cloth.

1921 625 .142.2 (06 (.73) et 691. (06 (.73)

AMERICAN WOOD PRESERVERS' ASSOCIATION.

Proceedings of the Seventeenth Annual meeting held at San Francisco, Cal., on January 25, 26, 27, 1921.

Madison, Wis., published by the Association, the Secretary (6×9 inches), 591 pages, illustrated.

1921 621 .14 (02

Automobile engineering, a great reference work; prepared by a staff of automobile experts, consulting engineers, and designers of the highest professional standing.

Chicago, American Technical Society, 8vo, 6 volumes with over 1 500 engravings. (Price : $29.80.)

1921 385. (09 .1 (.4)

Bartholomew's general map of Europe. Showing boundaries of States according to treaties.

Edinburgh, John Bartholomew & Son Limited, Duncan street. (Price : 1 sh. net.)

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(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science," by A. Weissenbruch, in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1921 691. (02

BAXTER (L. H.), supervisor of manual training.

Elementary concrete construction.

Milwaukee, Wis., The Bruce Publishing Company (6×9 inches), 101 pages, illustrated. (Price : $1.25.)

1921 385. (07.11

COLE (H. L.), O. B. E., M. I. Mech. E., Secretary Railway Board.

Technical education in relation to railways in America. Technical paper No. 219.

Simla, India (8×13 inches), 46 pages, illustrated. (Price : 14 Annas.)

1921 721.9 (02

HATT & VOSS.

Concrete work. Volume II.

New York, 532, Fourth Avenue, John Wiley & Sons (5×7 1/2 inches), 206 pages, illustrated.

1921 625 .142.4

INDIAN RAILWAY BOARD.

Concrete railway sleepers.

Calcutta, Superintendent of Government Printing (8×13 inches), 88 pages, folding plates & illustrations. (Price: Rupees 3, Annas 4.)

1921 313 .385 (.66) & 385. (08 (.66)

NIGERIAN RAILWAYS AND UDI COAL MINES.

Administrative report for the year 1920.

Ebute Metta, printed at the Railway Press. 106 pages, with appendices and a map.

1921 656 .235

Proposed railway classification of goods by mercha dise trains. Chart No. 1.

Huddersfield, Hirst & Adamson, 13, Market Cro Chambers. (Price : 1 sh. 6 d.)

1921 351 .812 (.42

Railways Act, 1921.

London, W. C. 2. Printed by Eyre and Spottiswoo Ltd. To be purchased from H. M. Stationery Offic Imperial House, Kingsway, London W. C. 2. In-8 90 pages.

1921 313 .385 (.42) & 385. (08 (.42

Returns of the capital, traffic receipts and workin expenditure of the Railway companies of the Unite Kingdom for the year 1920.

London, H.-M. Stationery Office, 280 pages. (Price 10 sh. net.)

1921 721 .3 (0

SALMON (E. H.).

Columns : a treatise on the strength and design compression members.

London, Henry Frowde and Hodder & Stoughto (6×9 inches), 279 pages, illustrated. (Price 31 sh. 6 net.)

1921 621 .7 (0

STANLEY (Frank A.).

Railroad shop practice.

London, McGraw Hill Publishing Co. Ltd, 6 and Bouverie street, E. C. (9 1/4×6 inches), 331 page (Price : 24 sh. net.)

[016 .385. (05]

II — PERIODICALS.

In French.

Annales des ponts et chaussées. (Paris.)

1921 62. (01

Ann. des ponts et chauss., part. techn., juill.-août, p. 5.

BENABENQ (F.). — **Résistance des pieux** (4 900 mots, 1 tableau & fig.)

1921 625 .1

Ann. des ponts et chauss., part. techn., juill.-août, p. 68.

NABONNE. — **Procédés récents d'exécution des travaux publics.** (4 000 mots & fig.)

1921 625 .13

Ann. des ponts et chauss., part. techn., juill.-août, p. 111.

REZEAU. — **Remplacement d'une des voûtes du pont de Meulan par une travée métallique.** (1 700 mots & fig.)

Annales des travaux publics de Belgique. (Bruxelles.)

1921 624 .52

Ann. des trav. publ. de Belgique, octobre, p. 745.

VIERENDEEL (A.). — **Pont suspendu rigide sur câbles.** (13 000 mots, tableaux et planches.)

1921 721 .3 (0

Ann. des trav. publ. de Belgique, octobre, p. 806.

LEMAIRE (L.)— **Le calcul des colonnes** (4 200 mots

Bulletin de l'Association internationale des chemins de fer. (Bruxelles.)

1921 656 .2

Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 209

HENRY-GREARD. — **Prix de revient; tarificatio** (question XIII, 9e congrès). Exposé n° 2 (tous les pay sauf l'Amérique). (8 500 mots.)

1921 621 .133. (01, 621 .134.3 & 621 .134

Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 211

CHURCHWARD (G. J.). — **Production et utilisatio économiques de la vapeur des locomotives** (question 9e congrès). Exposé n° 2 (pays de langue anglaise (4 500 mots & fig.)

1921 621 .135.2, 621 .135.3 & 621 .135

Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 212

HUGHES (G.). — **Bogies, essieux et suspension d locomotives** (question VI, 9e congrès). Exposé n° 3 (pay de langue anglaise). (12 600 mots, 12 tableaux & fig

1921 656 .223.2
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2213.
CHARRON. — **Echange du matériel** (question XV, 9e congrès). Supplément à l'exposé n° 2 (tous les pays, sauf l'Amérique). (1 800 mots.)

1921 625 .14 (01
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2217.
TRENCH (E. F. C.). — **Etablissement de la plate-forme et de la voie** (question I, 9e congrès). Exposé n° 5 (Grande-Bretagne). (43 000 mots & fig.)

1921 656 .211
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2307.
BALDWIN (A. S.). — **Gares terminus à voyageurs** (question IX, 9e congrès). — Exposé n° 1 (pays de langue anglaise) (13 900 mots, 15 tableaux & fig.)

1921 621 .133.1
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2359.
FOWLER (Sir Henry). — Note sur l'utilité d'étudier la question de l'**emploi du combustible liquide dans les locomotives** (Motion 9e congrès). 3 000 mots, 33 tableaux & fig.)

1921 656 .253
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2412.
LASCELLES (T. S.). — Le système électro-mécanique Sykes **d'arrêt automatique des trains.** (2 800 mots & fig.)

1921 656 .253
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2421.
Systèmes automatiques de **signalisation des chemins de fer.** (1 700 mots.)

1921 385. (07.12 (.73)
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2423.
STANLEY (F. A.). — **Système d'apprentissage du « Southern Pacific Railway ».** (1 900 mots & 1 tableau.)

1921 385 .15 (.42)
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2427.
La restitution des chemins de fer britanniques à l'industrie privée. (1 400 mots.)

1921 385 .15 (.42)
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2429.
Le nouveau régime des chemins de fer en Grande-Bretagne. (1 100 mots.)

1921 385. (09.2
Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 2431.
NECROLOGIE. — **Albert Sartiaux.** (900 mots & 1 portrait.)

Génie civil. (Paris.)

1921 625 .143.3
Génie civil, n° 2049, 19 novembre, p. 429.
Les causes de **l'usure prématurée des rails.** (3 300 mots & fig.)

1921 624 .2 (01
Génie civil, n° 2049, 19 novembre, p. 439.
DESCANS (L.). — **Le calcul des portiques continus.** (2 700 mots & fig.)

1921 385 .1 (.44) et 656 .23 (.44)
Génie civil, n° 2050, 26 novembre, p. 458.
PEYRABON (G.). — Le nouveau **régime des chemins de fer français.** (5 200 mots & fig.)

La Science et la Vie. (Paris.)

1921 656 .211.7
La Science et la Vie, n° 59, novembre, p. 487.
DUCANGE (F.). — Les grands **ponts transbordeurs.** (5 000 mots & fig.)

Revue générale des chemins de fer et des tramways. (Paris.)

1921 621 .132.4 (.44)
Revue générale des ch. de fer, n° 5, novembre, p. 291.
LEBOUCHER. — Note sur les **locomotives Pacific** à deux cylindres à simple expansion et surchauffe de la Compagnie des chemins de fer du Midi. (4 000 mots, 5 tableaux & fig.)

1921 656 .255 (.42)
Revue générale des ch. de fer, n° 5, novembre, p. 304.
Note sur **l'exploitation des lignes à voie unique** dans le Royaume-Uni. (8 300 mots & fig.)

1921 385 .1 (.494)
Revue générale des ch. de fer, n° 5, novembre, p. 320.
Les prévisions des **Chemins de fer fédéraux suisses pour le rétablissement de leur équilibre financier.** (2 300 mots & 3 tableaux.)

1921 385 .1 (.73)
Revue générale des ch. de fer, n° 5, novembre, p. 325.
La rémunération du capital et du travail dans les **chemins de fer des Etats-Unis.** (1 300 mots & 1 tableau.)

1921 385 .1 (.43)
Revue générale des ch. de fer, n° 5, novembre, p. 327.
La **situation financière des chemins de fer allemands.** (1 000 mots & 5 tableaux.)

1921 625 .215 (.73)
Revue générale des ch. de fer, n° 5, novembre, p. 330.
Nouveau **bogie pour wagons à marchandises.** (900 mots & fig.)

In German.

Glasers Annalen für Gewerbe und Bauwesen. (Berlin.)

1921 625 .236
Glasers Ann. für Gewerbe u. Bauw, Heft 7, 1. Okt, S. 75.
HERMANN (H.). — Druckluftwaschapparat zur **Reinigung von Eisenbahnwagen.** (700 Wörter & Abb.)

1921 621 .132 .8 (.494)
Glasers Ann. für Gewerbe u. Bauw., Heft 8, 15. Okt. S. 88.
Zoelly-Dampfturbinen-Lokomotive mit Kondensation. (700 Wörter & Abb.)

Schweizerische Bauzeitung. (Zürich.)

1921 532
Schweizerische Bauzeitung, Nr. 21, 19. November, S. 245.
MUHLHOFER (L.). — Theoretische Betrachtungen zum Problem des **Druckstollenbaues.** (3 500 Wörter, 3 Tabellen & Abb.)

Zeitschrift des Vereines deutscher Ingenieure. (Berlin.)

1921 621 .133 .7

Zeitschr. des Ver. deutsch. Ingenieure, Nr. 47, 19. November. S. 1205.

GUNTHER. — **Speisewasservorwärmer für Lokomotiven.** (2 300 Wörter & Abb.)

Zeitung des Vereines deutscher Eisenbahnverwaltungen. (Berlin.)

1921 625 .212

Zeitung des Vereins. Nr. 44, 3. November, S. 814.

RÜKER (E). — **Das Hartguss- (Griffin-) Rad** im Eisenbahnbetrieb und seine Herstellung. (3 900 Wörter & Abb.)

1921 385 .586. (04

Zeitung des Vereins, Nr. 45, 10. November, S. 834.

HEINRICH. — Das **Eisenbahnbetriebspersonal** und seine Erziehung. (8 800 Wörter.)

1921 625 .245

Zeitung des Vereins, Nr. 47, 24. November, S. 875.

« **Das Kastensystem** » in Verbindung mit dem « Zweibahnensystem » und dessen Vorteile für den Lastentransport. (1 800 Wörter & Abb.)

In English.

Bulletin, American Railway Engineering Association. (Chicago.)

1921 624 .63 & 721 .9

Bull. Amer. Ry. Eng. Ass., no. 238, August, p. 3.

IRWIN (A. C.). — Developments in the **railway uses of concrete.** (20 000 words, 2 tables & fig.)

Bulletin of the International Railway Association. (Brussels.)

1921 625 .14 (01

Bull. of the Intern. Ry. Ass., No. 12, December, p. 2025.

MESNAGER. — **Special steels** (Subject III, 9th Congress). Report No. 3 (France). (5 900 words, 2 tables & fig.)

1921 621 .135.2, 621 .135.3 & 621 .135.4

Bull. of the Intern. Ry. Ass., No. 12, December, p. 2039.

MINSART (E.). — **Bogies (trucks) axles and springs of locomotives** (Subject VI, 9th Congress). Report No. 1 (Belgium, Denmark, Norway and Sweden). (8 900 words, 3 tables & fig.)

1921 625 .617

Bull. of the Intern. Ry. Ass., No. 12, December, p. 2075.

GAVIRAGHI (C.). — **Carriages and wagons for light railways** (Subject XVII, 9th Congress). Report. (8 000 words.)

1921 621 .33

Bull. of the Intern. Ry. Ass., No. 12. December, p. 2091.

GIBBS (G.). — **Electric traction** (Subject VIII, 9th Congress). Report No. 5 (America). (13 600 words, tables & fig.)

1921 621 .3

Bull. of the Intern. Ry. Ass., No. 12, December, p. 217

DONATI (A.). — **Electric traction** (Subject VII 9th Congress). Report No. 3 (Italy). (10 000 word 4 tables & fig.)

1921 624. (0

Bull. of the Intern. Ry. Ass., No. 12, December, p. 222

RONSSE (A.). — Limits of safety to allow fo stresses in the metallic superstructure of railwa bridges. (7 000 words, 5 tables & fig.)

1921 656 .253 (.42

Bull. of the Intern. Ry. Ass., No. 12, December, p. 224

D'HAENENS (L.). — **The train control system of th Midland Railway.** (5 000 words.)

1921 656 .25

Bull. of the Intern. Ry. Ass., No. 12, December, p. 225

NETTER (J.). — **Cab signalling** and automatic trai stops. (2 400 words & fig.)

1921 624. (01 (.42

Bull. of the Intern. Ry. Ass., No. 12, December, p. 225

Tests on **rail-bridges** carried out in Great Britain wit a view to determining impact values. (1 400 words fig.)

1921 625 .1

Bull. of the Intern. Ry. Ass., No. 12, December, p. 226

Maintenance work being done by contract. (2 45 words.)

1921 656 .25

Bull. of the Intern. Ry. Ass., No. 12, December, p. 226

Fool- proof **railway signalling.** (2 300 words.)

1921 385. (02 & 385. (0

Bull. de l'Ass. intern. des ch. de fer, n° 12, déc., p. 226

New books and publications : Trattato moderno materiale mobile ed esercizio delle ferrovie. (Treatis on modern rolling stock and the working of railways by F. TAJANI. (800 words.)

Electric Railway Journal. (New York.)

1921 621 .3

Electric Railway Journal, No. 14, October 1, p. 543.

Single phase gives way to the Automatic substatio (1 500 words & fig.)

1921 621 .33 (.45

Electric Railway Journal, No. 19, November 5, p. 81

Valtellina Railway is extended. (1 500 words & fig

Engineer. (London.)

1921 656 .25

Engineer, No. 3437, November 11, p. 520.

An Automatic mechanical train controller. (1 30 words & fig,)

1921 313 : 656.28 (.42

Engineer, No. 3439, November 25, p. 574.

Railway Accidents in 1920. (1 400 words & 2 tables

Engineering. (London.)

1921 53

Engineering, No. 2914, November 4, p. 621.

SKINNER (F. W.). — **The new Winnipeg wate works.** (5 800 words & fig.)

921 624 .2 (01
ineering, No. 2915, November 11, p. 656.
HOMPSON (T.). — **Beams with loads irregularly** ributed. (3 000 words, 1 table & fig.)

921 621 .131.2 (.73)
ineering, No. 2917, November 25, p. 743.
ARTINGTON (J.). — Avoidable waste in **locomotive** ation as effected by design. (3 800 words, 2 tables g.)

Engineering News Record. (New York.)

921 621 .95 & 625 .13
neering News-Record, No. 14, October 6, p. 555.
ew **machine completes tunnel** in one operation. words & fig.)

921 625 .17
ineering News-Record, No. 15, October 13, p. 602.
otection of **railway track** from falling rocks. words.)

921 625 .13 (.73)
ineering News-Record, No. 15, October 13, p. 606.
tting **large bascule** in service. (1 200 words & fig.)

921 625 .143.1 (.94)
neering News-Record, No. 15, October 13, p. 611.
ustralian **standard rail sections** and specifications. 00 words, 2 tables & fig.)

921 624 .52 (.73)
ineering News-Record, No. 15, October 13, p. 613.
ew **cantilever bridge** begun on the Ohio River. words & fig.)

921 721 .9
neering News-Record, No. 16, October 20, p. 638.
TUS (W. J.). — **Concrete girders** jacked up to ace settled bridge pier. (400 words & fig.)

921 624. (01 (.42)
neering News-Record, No. 16, October 20, p. 642.
sults of **impact tests on bridges** in England. (1 900 ds, table & fig.)

921 691. (01
neering News-Record, No. 16, October 20, p. 650.
ITT (J. C.). — Interpreting the chemical **analysis** ortland cement. (3 100 words.)

921 625 .13 (.73)
neering News Record, No. 17, October 27, p. 676.
IGGS (W.-C.). — **Timbered and roof-shield tun**g in deep loose-ground subway section. (4 700 words g.)

21 625 .142.4 (.45)
neering News-Record, No. 17, October 27, p. 689.
ncrete **block track supports** on Italian railways. words & fig.)

21 691
neering News-Record, No. 17, October 27, p. 695.
VAGE (H. N.). — Proportioning and **making con**on Barrett dam. (1 600 words & fig.)

1921 691. (01
Engineering News-Record, No. 17, October 27, p. 700.
JENKEN (C. L.). — Atmospheric conditions Hasten initial set of cement. (700 words.)

1921 624 .33 (.73)
Engineering News-Record, No. 18, November 3, p. 725.
PARKER (J. L.). — **Long concrete trestles** to cross Southern River swamps. (900 words & fig.)

1921 656 .212.8
Engineering News-Record, No. 20, November 17, p. 808.
BAILEY (C. C.). — **Locomotive track scale** shows load on each wheel. (1 000 words & fig.)

1921 691. (01
Engineering News-Record, No. 20, November 17, p. 812.
CRUM (R. W.). — Practical **use of excess sand in concrete mixtures.** (2 200 words, 1 table & fig.)

Journal of the Franklin Institute. (Philadelphia.)

1921 621 .39
Journal Franklin Institute, No. 5, November, p. 561.
RUDER (W. E.). — The science of **electric welding.** (5 000 words & fig.)

Proceedings, American Society of civil engineers. (New York.)

1921 721 .4 (01
Proceed., Amer. Soc. civil engin., No. 8, October, p. 261.
NOETZLI (F. A.).— The relation between deflections and stresses in **arch dams.** (8 300 words & fig.)

1921 721 .4 (01
Proceed., Amer. Soc. civil engin., No. 8, October, p. 285.
CAIN (W.). — **The circular arch** under normal loads. (4 000 words, 3 tables & fig.)

Railway Age. (New York.)

1921 656 .253 (.73)
Railway Age, No. 18, October 29, p. 817.
Automatic train control demonstrated on B., R. & P. (1 300 words & fig.)

1921 621 .132 .8 (.73)
Railway Age, No. 18, October 29, p. 841.
Bowen **Gasoline motor driven passenger car.** (1 200 words & fig.)

1921 656 .253 (.73)
Railway Age, No. 19, November 5, p. 867.
Proposed modification of **stop-and-proceed rule.** (1 500 words, 1 table & fig.)

1921 621 .33 (.73)
Railway Age, No. 19, November 5, p. 881.
Plan for **electrifying sections of 11 railroads.** (3 100 words, 1 table & fig.)

1921 621 .131 .2 (.73)
Railway Age, No. 19, November 5, p. 899.
PARTINGTON (J.). — **Designing locomotives** for economical operation. (3 800 words & fig.)

1921 621 .132.3 (.725) & 621 .132.4 (.725)
Railway Age, No. 20, November 12, p. 937.
New motive power for Railways of Mexico. (1 500 words, 1 table & fig.)

1921 625 .235 (.73)
Railway Age, No. 20, November 12, p. 941.
Illinois Central **steel suburban coaches.** (1 000 words & fig.)

1921 621 .335
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GIBBS (A. W.). — Selecting designs for **electric locomotives.** (2 500 words & fig.)

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GRIBBLE (C.). — The influence of rigid connections on the distribution of live loads on **railway underbridges** (2 400 words & fig.)

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1921 656 .253 (.42)
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Automatic train control, North Eastern Railway. (900 words & fig.)

1921 625 .253. (01
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Exceptional train loading in the United States and the **Westinghouse double capacity brake.** (1 400 words & fig.)

1921 625 .23 (.68)
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New all **steel suburban coaches** for the South African Railways. (600 words & fig.)

1921 625 .253. (01 (.73)
Railway Gazette & News, No. 20, November 11, p. 727.
Handling exceptional tonnage trains on down grades. (2 000 words & fig.)

1921 656 .251
Railway Gazette & News, No. 20, November 11, p. 735.
The « Hall » **colour light signal.** (1 600 words & fig.)

1921 625 .175
Railway Gazette & News, No. 22, November 25, p. 814.
A new portable **motor inspection car.** (500 words & fig.)

Railway Review. (Chicago.)

1921 625 .154 (.73)
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Twin-span **turntables** on the Chesapeake & Ohio. (2 200 words & fig.)

1921 621 .133.1
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CHILES (G. S.). — Effect of car weight and speed **on coal consumption.** (3 100 words & fig.)

1921 621 .131.2
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PARTINGTON (J.). — Notable accomplishmen **locomotive design.** (2 400 words, 2 tables & fig.)

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1921 656 .222.1
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ALLEN (C. J.). — **British locomotive practice performance.** (5 900 words & fig.)

1921 621 .33
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Railway electrification progress. (4 600 words &

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STARKIE (J. L.). — **Distributing expenditur** track maintenance. (2 200 words & fig.)

1921 621
Railway Maintenance Engin., No. 11, November, p
The construction and maintenance of **cinder** (1 900 words & fig.)

1921 62
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Lining tunnels under traffic. (4 400 words & fi

1921 62
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The construction and maintenance of **passenger forms.** (2 800 words & fig.)

1921 625
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NAVIN (J. J.). — **Handling snow and ice** in nals. (2 400 words & fig.)

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New **sleeping cars** for the Canadian Pacific. words & fig.)

1921 621 .132.8
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Bowen **gasoline motor driven passenger car.** words, 1 table & fig.)

Railway Signal Engineer. (Chicago.)

1921 656 .258
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BALL (J. B.). — **Interlocking** at a railway bri England. (3 800 words & fig.)

1921 656 .253
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Road test of new **automatic train control.** (1 600 & fig.)

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way Signal Engineer, No. 11, November, p. 433.
LLIET (H. S.). — Progress of Railroad signaling merica. (6 700 words.)

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NHAM (C. A.). — Absolute permissive block l system. (3 000 words & fig.)

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oposed modification of stop-and-proceed rule. (1 500 s & fig.)

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Giornale del genio civile. (Roma.)

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ale del Genio civile, 31 Ottobre, p. 605.
OYA (O.). — Contributo allo studio sulla distribu- più conveniente dell'armatura doppia nei solidi ntizi inflessi. (3 300 parole, 3 tabelle & fig.)

1921 625 .13 (09 .3 (.45)
Giornale del Genio civile, 31 Ottobre, p. 655.
Il primo cinquantenario della galleria del Moncenisio. (3 200 parole & fig.)

In Spanish.

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MURUA (J.). — Coche americano sin bastidor. (2 400 palabras, 1 cuadro & fig.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1921 625 .1 (.51)
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DEKING DURA (J. C.). — Spoorwegaanleg in China. (650 woorden & fig.)

1921 621 .133.1
Ingenieur, N^r 45, 5 November, p. 875.
FRANCO (I.). — Het Stoken met kolenpoeder. (10 000 woorden & fig.)

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[016 .385. (02]

I. — BOOKS.

In French.

1921 721. (02

ARNAUD (M. E.), professeur à l'Ecole centrale des arts et manufactures.

Cours d'architecture et de constructions civiles. Première partie : Ensemble des opérations à envisager pour l'édification des bâtiments. Deuxième partie : Technique du bâtiment. Tome I: Béton armé. Fondation. Maçonnerie. Planchers. Tome II : Combles. Couvertures. Escaliers. Tome III : Serrureries. Installations diverses et décoration.

Paris, Imprimerie des arts et manufactures, M. Barnagaud, 8, rue du Sentier. In-8°, 1re partie; 188 pages et 22 planches; 2e partie: Tome I, 554 pages et fig.; tome II, 554 pages et fig.; tome III, 532 pages et fig.

1921 624 .2 (01

MAGNEL (G.), répétiteur à l'Université de Gand, chef des travaux au laboratoire de résistance des matériaux.

Calcul pratique des **poutres continues en béton armé,** en tenant compte de la raideur des colonnes.

Gand, Van Rysselberghe & Rombaut, éditeurs, (15×25 cm.), 60 pages et planches. (Prix : 30 francs.)

1921 62. (02

OCAGNE (Maurice d'), inspecteur général des ponts et chaussées, professeur à l'Ecole polytechnique.

Traité de nomographie. Etude générale de la représentation graphique cotée des équations à un nombre quelconque de variables. Applications pratiques.

Paris, Gauthier-Villars et Cie, éditeurs. 2e édition, in-8° (25×16) de XXIV-484 pages, 182 fig. et 1 planche. (Prix : 50 francs.)

1921 51. (02

VEZO (L.), professeur de l'enseignement technique.

Les mathématiques de l'ouvrier moderne.

Paris, Dunod, éditeur, I. Arithmétique et algèbre. (13×21) de 242 pages, 69 fig. (prix : 13 fr.). II : Géométrie. (13×21) de XV-276 pages, 530 fig. (prix : 14 fr.).

In German.

1921 385. (02

BLUM (Otto), Dr. Ing., Professor an der Technischen Hochschule in Hannover.

Der Weltverkehr und seine Technik im 20. Jahrhundert.

Stuttgart und Berlin, Deutsche Verlagsanstalt, 8° 2 Bände, 300 und 309 Seiten, 45 Abbildungen (Preis geb.: 72 Mark.)

1921 62. (01

MEMMLER (K.), Prof. Dipl. Ing.

Einführung in die moderne Technik der Materialprüfungen. Erster Teil: Allgemeine Materialeigenschaften Festigkeitsversuche — Hilfsmittel für Festigkeitsversuche.

Berlin und Leipzig, Vereinigung wissenschaftlicher Verleger (Sammlung Göschen) 3. verbesserte Auflage mit 58 Abb. (Preis : 2.10 Mark und 100 % Zuschlag.)

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SCHAU (A.), staatl. Baugewerkschuldirektor.

Der Brückenbau. I. Teil.

Leipzig und Berlin, Verlag von B. G. Teubner, Dritte Auflage, mit 334 Abbildungen und 6 Tafeln. (Preis : 13.60 Mark.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science," by L. Weissenbruch, in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

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STRASSNER (A.), Oberingenieur.

Neuere Methoden zur Statik der Rahmentragwerke und der elastischen Bogenträger. Erster Band : Der durchlaufende Rahmen.

Berlin, Wilhelm Ernst & Sohn, Zweite, durchweg neu bearbeitete Auflage, 150 Seiten mit 170 Textabbildungen. (Preis geh. : 34 Mark.)

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STRASSNER (A.), Oberingenieur.

Berechnung statisch unbestimmter Systeme. Erster Band : Der einfache und durchlaufende Balken.

Berlin, Wilhelm Ernst & Sohn. 148 Seiten mit 192 Textabbildungen. (Preis, geh.: 33 Mark.)

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WUNDENBERG (H.), Eisenbahningenieur.

Handbuch für den Eisenbahnoberbau.

Oberhausen (Rhld.), Bahnhofstrasse, 1, Selbstverlag. (Preis : 10 Mark ohne Porto.)

In English.

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AMERICAN RAILWAY ASSOCIATION.

Historical statement. Present activities.

New York.The American Railway Association: Mr. J. E. Fairbanks, General Secretary and Treasurer, 75 Church Street. 8°, 134 pages.

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KINK (Everett Edgar), Member of the American Railway Association, signal section.

Railway signalling.

New York and London, McGraw Hill Book Co (6×9 inches), 371 pages, illustrated. (Price: $4.)

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TORRE (D. Enrique de la).

Annuario de ferrocarriles.

Madrid, Administracion : San Vicente Alta, 54, pral 339 páginas, encuadernado en tela. (Precio : 16 pesetas.

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Génie civil, n° 2051, 3 décembre, p. 496.

Machines d'essais, donnant la limite élastique et le module d'élasticité des métaux. (650 mots & fig.)

1921 625 .13 (.44)

Génie civil, n° 2052, 10 décembre, p. 516.

Les progrès techniques réalisés dans la reconstruction des ouvrages d'art des chemins de fer du Nord et de l'Est. (3 900 mots & fig.)

1921 656 .212.6 (.44)

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L'installation pour le déchargement et la manutention des grains, à Bordeaux-Bassens. (3 500 mots & fig.)

1921 624 .2 (01

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SMOUKOVITCH & BARBILLION. — Détermination graphique des moments fléchissants maxima dans une poutre supportant des charges mobiles par l'intermédiaire des traverses. (2 000 mots & fig.)

Les chemins de fer et les tramways. (Paris.)

1921 621 .133.1

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GUESDON (P.). — Chauffage des chaudières de locomotives au charbon pulvérisé et aux combustibles liquides. (1 800 mots & fig.)

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1921 656 .25

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PICARD. — Note sur le moteur électrique de signa de la compagnie de l'Est. (1 400 mots & fig.)

1921 656 .212.6 (.43

Revue générale des ch. de fer, n° 6, décembre, p. 346.

GAUBERT (H.). — Appareils de déchargement mé canique des wagons-tombereaux allemands. (8 500 mot & fig.)

1921 .313 .385 (.73

Revue générale des ch. de fer, n° 6, décembre, p. 368.

La situation des chemins de fer aux Etats-Unis (1 300 mots & 3 tableaux.)

1921 621 .138.

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Réparation par soudure autogène des foyers en cuivr de locomotive. (3 200 mots & fig.)

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GOUTTIER (J.). — **L'usure des rails** de chemins de et de tramways. (4 000 mots, 5 tableaux & fig.)

1921 621 .132

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REMY. — Die **Geschichte der serbischen Eisenbahnen.** 2 000 Wörter, 11 Tabellen & Abb.)

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Die Neuorganisation der Schweizer. Bundesbahnen. 2 000 Wörter.)

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Die Eisenbahnen Griechenlands vor und nach dem ieg. (1 300 Wörter & 4 Tabellen.)

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Die Eisenbahnen Japans 1914/15-1918/19. (300 Wörter Tabellen.)

1921 313 .385 (.492)

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FINDEIS (R.). — Erfahrungen und Erkenntnisse aus dem Kriegseisenbahnbetriebe hinsichtlich der Ausgestaltung der **Verkehrsanlagen für erhöhte Leistungen.** (4 000 Wörter & Abb.)

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1921 625 .151

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WENSKY (F. A.). — Schnappverschlüsse für **Weichenzungen.** (800 Wörter.)

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BEHR (H.). — **Kugel- und Rollenlager** für Schienenfahrzeuge. (4 500 Wörter & Abb.)

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Statistics of New York traffic. (1 800 words, 3 tables & fig.)

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Electric locomotive drives. (2 600 words.)

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1921 691

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Cement stucco covering for small railway buildings. (800 words & fig.)

1921 624. (01

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LINDENTHAL (G.). — Some thoughts on **long-span bridge design.** (5 000 words.)

1921 625 .13

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Driving a 20 000 sec. ft. flood protection **tunnel.** (3 700 words & fig.)

1921 721 .9

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Rapid renewal of **turntables** at engine terminals. (1 000 words.)

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Nashville **concrete bridges** show serious deterioration. (3 700 words & fig.)

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Construction systematized in **soft ground tunnel.** (1 500 words & fig.)

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SACKETT (H. S.). — The **use of wood in freight** construction. (4 000 words, 1 table & fig.)

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ELMER (W.). — Avoiding waste in the **operatio locomotives.** (3 200 words, 1 table & fig.)

1921 625 .142.2 &

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Norfolk & Western goes to **treated cross ties.** (words & fig.)

1921 656 .283 (

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Disastrous **collision** on Philadelphia & Reading. (words & fig.)

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1921 625 .

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ALLEN (C. J.). — **Sound steel in rail manufac** (3 500 words.)

Railway Gazette & News. (London.)

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Oil burning **tank engine**, North British Railway. (350 rds & fig.)

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The building of **electric locomotives** and equipment. 400 words & fig.)

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1921 656 .284
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1921 621 .138.3
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1921 625 .235 (.73)
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Railway Review. (Chicago.)

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Illinois Central **suburban operation and equipment.** (4 300 words & fig.)

1921 621 .132.8 (.73)
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Gasoline rail car proves short line salvation. (1 600 words & fig.)

1921 621 .138 (.73)
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New **engine terminal facilities** for the Pere Marquette Railway, at Saginaw, Mich. (3 300 words & fig.)

In Italian.

Giornale del Genio civile. (Roma.)

1921 624 .6
Giornale del Genio civile, 30 novembre, p. 677.
Il nuovo **ponte sul Piave** in località « Ponte nelle Alpi ». (4 900 parole, 15 tabelle & fig.)

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1921 624 .63 (.45)
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PARTANNI (S.). — **Passerella pedonale a volto di calcestruzzo di cemento** nella stazione di Varese. (500 parole & fig.)

1921 621 .133.3
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BARAVELLI (P.). — Sui moderni criteri di valutazione dell'efficienza della **caldaie da locomotiva.** (7 600 parole, tabelle & fig.)

1921 385. (09.1 (.45)
Rivista tecnica delle ferrovie ital., No. 4, 15 ott., p. 127.
GEROSA (E.). — **L'avvenire ferroviario** del Trentino. (8 200 parole & 1 tavola.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1921 656 .284 (.92)
Ingenieur, N° 49, 3 December, p. 969.
DYXHOORN (F. J.). — **Baan- en talud-afschuivingen** in Nederlandsch-Indië. (4 800 words & fig.)

Monthly Bibliography of Railways [1]

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[016 .385. (02]

I. — BOOKS.

In French.

1921 — 621 .3 (02

BECQ (Albert), ingénieur-conseil de la Banque de la Seine.

Cours élémentaire d'électricité théorique et industrielle.

Livre I : Electricité théorique et Machines.

Villeneuve-Saint-Georges (Seine-et-Oise), Imprimerie l'Union typographique; Paris, Ecole spéciale des travaux publics, rue du Sommerard, rue Thénard et boulevard Saint-Germain. 12e édition, in-8°, 351 pages & fig.

1922 — 721 .9 (02

BRAIVE (Jean), ingénieur des arts et manufactures; **MESNAGER (A.),** inspecteur général des ponts et chaussées.

Aide-mémoire de l'ingénieur-constructeur de béton armé.

Paris (VIe), Dunod, éditeur, 47 et 49, quai des Grands-Augustins. 3e édition (13.5 × 21.5) de XLII-387 pages, avec 90 fig. (Prix : 20 francs.)

1921 — 625 .4 (.44)

COMPAGNIE DU CHEMIN DE FER METROPOLITAIN DE PARIS.

Règlement général d'exploitation approuvé par décision préfectorale du 13 mai 1911 et modifié par décisions préfectorales du 14 septembre 1914, 28 septembre 1916 et 20 mai 1920.

Paris, impr. et libr. Chaix, 20, rue Bergère. In-16, 60 pages.

1921 — 621 .3 (02

HARDY (M.), ingénieur des télégraphes.

Cours pratique d'électricité théorique et industrielle.

Livre Ier : Notions d'électricité théorique.

Villeneuve-Saint-Georges (Seine-et-Oise), Imprimerie l'Union typographique; Paris, Ecole spéciale des travaux publics, rue du Sommerard, rue Thénard et boulevard Saint-Germain. In-8°, 272 pages avec fig.

1921 — 385 .1 (.44)

LE TROCQUER (Yves), ministre des travaux publics; **DOUMER (Paul),** ministre des finances.

Compagnies de chemins de fer liées vis-à-vis de l'Etat par des conventions financières. Comptes des dépenses d'établissement au 31 décembre 1912. Comptes des recettes et des dépenses d'exploitation de l'année 1912. Situation au 31 décembre 1912 du compte courant de la garantie et des avances faites par l'Etat à titre de subventions en exécution de l'article 37 de la loi de finances du 30 mai 1899.

Paris, Impr. Nationale. In-4°, 133 pages.

1921 — 624. (02

MÉTOUR (E.), ingénieur des ponts et chaussées en retraite.

Méthode de calcul des ponts métalliques, travées **posées et continues, ponts-grues-arcs** (appliquant les prescriptions du règlement ministériel du 8 janvier 1915).

Chartres, impr. Durand; Paris (VIe), Dunod, éditeur, 47-49, quai des Grands-Augustins. In-8°, VIII-443 pages avec fig. (Prix net : 80 francs.)

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1921 — 721 .9 (02

Beton-Kalender 1922. Taschenbuch für Beton-und Eisenbeton.

Berlin, Verlag von Wilhelm Ernst & Sohn. Mit 505 Abbildungen. (Preis, kart. : 27 Mark.)

1921 — 656 .212

CAUER (W.), Dr. Ing.

Eisenbahnausrüstung der Häfen.

Berlin, Verlag von Julius Springer. Mit 51 Abbildungen. (Preis, geh. : 12 Mark.)

1922 — 721 .9 (02

EMPERGER (F.), Dr.

Handbuch für Eisenbetonbau, Achter Band : Eisenbahn-, Berg- und Tunnelbau, Stadt- und Untergrundbahnen.

Berlin, Verlag : W. Ernst & Sohn. III. neubearbeitete Auflage. (Preis : 468 Mark für das Ausland.)

1921 — 62. (02

FOERSTER (Max), Dr. Ing.

Taschenbuch für Bauingenieure.

Berlin, Verlag von Julius Springer, Vierte verbesserte und erweiterte Auflage. In zwei Teilen, 2 399 Seiten, mit 3 195 Abbildungen. (Preis, gebunden : 160 Mark.)

1921 — 721 .9 (02

KLEINLOGEL (A.), Prof. Dr.-Ing.

Veranschlagen von Eisenbetonbauten. Grundlagen für den Entwurf und für die Kostenberechnung von Tief- und Hochbauten.

Berlin, Verlag von Wilhelm Ernst & Sohn. Zweite, neubearbeitete Auflage, mit 23 Abbildungen. (Preis, geh. : 33 Mark.)

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(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science," by L. Weissenbruch, in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

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1922 621. (02

Calvert's mechanics' almanack, 1922.
London, John Heywood, Limited (6 1/2 × 4 × 1/4 inches), 176 pages. (Price : 6 d. net.)

1922 621 .3 (09.3

FLEMING (J. A.), M. A., D. Sc., F. R. S., professor of electrical engineering in the University of London.
Fifty years of electricity. The memoirs of an electrical engineer.
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1922 621 .1 (02

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1922 625 .15

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Permanent way, diagrams giving the spread of crossings, etc.
London, Spon. 8vo, 4th edition. (Price : 6 s. net.)

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A text-book of applied mechanics and mechanical engineering. Vol. 5 : Theory of machines and practical mechanisms.
London, Griffin. 9th edition, 8vo (7 3/4 × 5 1/4 inches), 546 pages. (Price : 9 s. net.)

1921 385. (02

JOHNSON (Emory R.), Ph. D., Sc. D. and **VAN METRE (Thurman W.),** A. M., Ph. D.
Principles of railroad transportation.
New York and London, D. Appleton & Co. 617 pages (Price : $3.50.)

1921 721. (02

KIDDER (Frank Eugene) & NOLAN (Thomas).
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A handbook for architects, structural engineers, builders, and draftsmen.
New York, Wiley. 17th edition, 1 907 pages, illustrated. (Price : $7 net.)

1921 62. (02

McCULLOUGH (Ernest).
Practical structural designs; a text and reference work for engineers, architects, builders, draftsmen and technical schools.
New York, U. P. Bk. Co., 241 W. 39th Street, 8vo 317 pages. (Price : $3 net.

1921 621 .3 (02

The practical electrician's pocket book and diary, 1922
London, W. C. 2., S. Rentell & Co. Limited, 36, Maiden Lane, Strand. (5 1/4 × 3 3/4 × 1 inches), 558 pages and diary. (Price : 3 s. net.)

1922 656 .235 (.73)

WILLIAMS (Harry G.) & FAGG (Charles J.).
The freight traffic red book; a practical reference book for those actively engaged in traffic work.
New York, The Traffic Pub. Co., 150 Lafayette St. 4°, 474 pages & tables. (Price : $6 net.)

[016 .385. (05]

II. — PERIODICALS.

In French.

Annales des chemins de fer et tramways. (Paris.)

1922 351 .812.1 (.44)

Ann. des ch. de fer et tramw., 1re, 2e et 3e livrais., p. 1.
Le **nouveau régime légal des chemins de fer.** (25 000 mots.)

Annales des ponts et chaussées. (Paris.)

1921 625 .13

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CLAISE. — **Palplanches métalliques** utilisées à la reconstruction des ponts de chemin de fer sur la Meuse, détruits pendant la guerre. (3 400 mots, 1 tableau & fig.)

1921 624 .63

Ann. des ponts et chauss., part. adm., sept.-oct., p. 194.
DELFORGES. — Note sur la **reconstruction du pont** de Brasles, sur la Marne, près de Château-Thierry. (4 800 mots, 3 tableaux & fig.)

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1921 351 .812.1 (.44)

Bull. annoté des ch. de fer, novembre et décembre, p. 61.
Loi relative au **nouveau régime des chemins de fer d'intérêt général.** (6 500 mots.)

Bulletin technique de la Suisse romande. (Lausanne.)

1921 621 .338

Bull. techn. de la Suisse romande, n° 26, 24 déc., p. 301.
STREHLER (H.). — **Appareil de graissage automatique pour les boudins des roues** de voitures automotrices électriques. (1 300 mots & fig.)

1922 625 .13 (.494)

Bull. techn. de la Suisse romande, n° 2, 21 janv., p. 13.
L'achèvement du deuxième **tunnel du Simplon.** (2 300 mots, 2 planches & fig.)

Génie civil. (Paris.)

1921 62. (01 & 625 .143 (01

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TIMOCHENKO (S.). — **Etude de l'action des charges roulantes sur les rails.** (1 400 mots.)

1921 625 .25 (01
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NETTER (J.). — **Le freinage continu des longs trains de marchandises.** (4 000 mots & fig.)

1921 625 .142 & 621 .9
Génie civil, n° 2055, 31 décembre, p. 577.
PALLET (A.).— **Machines à saboter, à percer, à tronçonner et à marquer les traverses de chemins de fer, système Greenlee.** (3 800 mots & fig.)

1922 624 .2 (01
Génie civil, n° 2056, 7 janvier, p. 11.
LEGENS (L.). — **Calcul des poutres à treillis double avec membrures parallèles et montants verticaux sur les appuis seulement.** (900 mots & fig.)

1922 625 .253
Génie civil, n° 2056, 7 janvier, p. 15.
Valve de queue « Oméga », pour **frein continu automatique à air comprimé.** (1 100 mots & fig.)

1922 624 .63
Génie civil, n° 2057, 14 janvier, p. 37.
DANTIN (Ch.). — Procédé de construction, sans cintres, **des grands arcs en béton armé.** (4 500 mots & fig.)

1922 656 .235 (.44)
Génie civil, n° 2058, 21 janvier, p. 58.
PEYRABON (G.). — La semaine des transports et la revision des **tarifs de marchandises.** (3 800 mots.)

1922 656 .212.6
Génie civil, n° 2058, 21 janvier, p. 67.
Chargeurs radiaux, système Jeffrey, pour la **manutention des matières pondéreuses.** (1 000 mots & fig.)

1922 691. (01
Génie civil, n° 2059, 28 janvier, p. 79.
LOSSIER (H.). — Le **béton armé** et le « ciment fondu ». Construction des ouvrages en béton armé à grande portée. (4 400 mots, 1 tableau, 1 planche & fig.)

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1922 656 .253
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BOYSSON (de). — La **répétition des signaux et l'arrêt automatique des trains** sur les chemins de fer américains. (4 800 mots.)

1922 621 .132 (.460)
Revue générale des ch. de fer, n° 1, janvier, p. 12.
RENNES. — **Transformations effectuées sur d'anciennes locomotives** de la Compagnie des chemins de fer andalous. (1 200 mots & fig.)

1922 625 .175
Revue générale des ch. de fer, n° 1, janvier, p. 21.
NIVERT (E.). — Véhicule à tablier roulant ou « Trottorail » **pour le transport des ouvriers** poseurs du service de la voie. (1 200 mots & fig.)

1922 351 .812.1 (.42)
Revue générale des ch. de fer, n° 1, janvier, p. 27.
PESCHAUD (M.). — Le nouveau régime des **chemins de fer de la Grande-Bretagne.** (9 600 mots, fig. & annexe.)

1922 625 .253 & 625 .254
Revue générale des ch. de fer, n° 1, janvier, p. 44.
GREPPI (L.). — Note sur l'application du **frein continu** aux trains de marchandises. (10 400 mots & fig.)

1922 313 .385 (.44)
Revue générale des ch. de fer, n° 1, janvier, p. 59.
Résultats obtenus en 1920 sur les réseaux des cinq compagnies principales des chemins de fer français (Nord, Est, Orléans, Paris-Lyon-Méditerranée et Midi). (8 tableaux.)

1922 625 .235
Revue générale des ch. de fer, n° 1, janvier, p. 75.
Nouvelles **voitures allemandes** à carcasse métallique. (3 000 mots & fig.)

1922 351 .812.2 (.44)
Revue générale des ch. de fer, n° 1, janvier, p. 85.
Loi du 29 octobre 1921 relative au **nouveau régime des chemins de fer d'intérêt général.** (9 500 mots.)

Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1922 721 .9
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MAGNEL (G.). — Recherches expérimentales sur le **coefficient d'élastricité du béton.** (5 500 mots, 4 tableaux & fig.)

1922 025 .4
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LAMALLE (U.). — Note sur la **classification décimale.** (4 800 mots & tableau.)

In German.

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1922 385. (09.3 (.42)
Archiv für Eisenbahnw., Heft 1, Jan. und Febr., S. 1.
BOEHLER (E.). — Die **englische Eisenbahnpolitik** der letzten vierzig Jahre. (1882-1922). (19 000 Wörter & 2 Tabellen.)

1922 385. (07.13
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LIST.— Ueber die **theoretische Ausbildung von Eisenbahn-Beamten und -Arbeitern.** (5 300 Wörter.)

1922 313 .385 (.433)
Archiv für Eisenbahnw., Heft 1, Jan. und Febr., S. 142.
Die **bayerischen Staatseisenbahnen** in den Jahren 1917 und 1918. (Tabellen.)

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Archiv für Eisenbahnw., Heft 1, Jan. und Febr., S. 153.
Die **Eisenbahnen der Schweiz** in den Jahren 1918 und 1919. (400 Wörter & Tabellen.)

1922 313 .385 (.45)
Archiv. für Eisenbahnw., Heft 1, Jan. und Febr., S. 163.
Die **italienischen Staatsbahnen** 1914-1916. (Tabellen.)

1922 313 .385 (.481)
Archiv für Eisenbahnw., Heft 1, Jan. und Febr., S. 178.
Die **Eisenbahnen in Norwegen** in den Jahren 1918-19 und 1919-20. (Tabellen.)

1922 313 .385 (.51)
Archiv für Eisenbahnw., Heft 1, Jan. und Febr., S. 186.
BALTZER. — Die **chinesischen Eisenbahnen** im Jahr 1919. (1 300 Wörter & 6 Tabellen.)

Glasers Annalen für Gewerbe und Bauwesen. (Berlin.)

1921 621 .335 (.436)
Glasers Ann. für Gewerbe u. Bauw., Heft 11, 1.Dez., S.133.
BAECKER. — Die **Arlberglokomotiven** der österreichischen Bundesbahnen. (2 000 Wörter, 2 Tabellen & Abb.)

1921 621 .132.5 (.434)
Glasers Ann. für Gewerbe u. Bauw., Heft 11, 1.Dez.,S.140.
1 F. **Vierzylinderverbund-Heissdampflokomotive** der württembergischen Staatseisenbahnen. (1 800 Wörter, 1 Tabelle & Abb.)

1921 621 .33 (.494)
Glasers Ann. für Gewerbe u.Bauw.,Heft 12, 15.Dez.,S.149.
BAECKER. — **Elektrisierung der Gotthardbahn.** (1 300 Wörter & Abb.)

1921 621 .131.2
Glasers Ann. für Gewerbe u. Bauw.,Heft 12,15.Dez.,S.161.
Der **Entwurf grosser Lokomotiven.** (4 200 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens in technischer Beziehung. (Berlin und Wiesbaden.)

1921 625 .143.3
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EGERT. — Kosten der **Gleiserhaltung.** (600 Wörter & Abb.)

1921 656 .253
Organ für die Fortschr.des Eisenb.,Heft 22,15.Nov.,S.261.
SALLER. — **Schutzsignale** bei Eisenbahnen. (1 000 Wörter & Abb.)

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Organ für die Fortschr.des Eisenb.,Heft 22,15.Nov.,S.264.
Länge der **Eisenbahnen der Erde 1917.** (1 Tabelle.)

Schweizerische Bauzeitung. (Zürich.)

1921 313 .385 (.494)
Schweizerische Bauzeitung, Nr. 26, 24. Dez., S. 315.
Die **schweizer. Eisenbahnen** im Jahre 1920. (2 000 Wörter.)

1922 625 .13 (.45)
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STURZENEGGER (P.). — Die **eisernen Ueberbauten der Centovalli-Bahn,** Ferrovia Locarno-Domodossola. (1 400 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

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Die **Rangiersignalanlage** in Neudietendorf. (1 500 Wörter & Abb.)

Zeitung des Vereins deutscher Eisenbahnverwaltungen. (Berlin.)

1922 625 .232 (.43)
Zeitung des Vereins, Nr. 51, 22. Dezember, S. 963.
Einfuhrung von **Schlafwagen** auf den deutschen Reichsbahnen. (1 000 Wörter & Abb.)

In English.

Engineer. (London.)

1921 621 .33
Engineer, No. 3443, December 23, p. 673.
RAVEN (Sir Vincent L.). — **Railway electrification.** (4 500 words, tables & fig.)

1922 621 .132.1 (.42)
Engineer, No. 3445, January 6, p. 10.
Locomotives in 1921. (2 800 words & fig.)

1922 621 .33 (.494)
Engineer, No. 3447, January 20, p. 68.
The **electrification of the St. Gothard Railway.** (2 300 words & fig.)

1922 621 .33 (.42)
Engineer, No. 3448, January 27, p. 104.
The **electrification** of English main line railways (3 900 words.)

Engineering. (London.)

1921 725 .31 (.73)
Engineering, No. 2921, December 23, p. 842.
The **moving of brick buildings.** (2 000 words & fig.)

1921 624 .52 (.944)
Engineering, No. 2922, December 30, p. 880.
Proposed cantilever bridge at Sydney, New South Wales. (5 600 words & fig.)

1922 621 .13 & 621 .33
Engineering, No. 2923, January 6, p. 25.
RAVEN (Sir V. L.). — **Railway electrification.** (5 400 words & 4 tables.)

1922 625 .25
Engineering, No. 2924, January 13, p. 43.
Railway brakes for heavy traffic. (1 800 words.)

1922 654 .6
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The development of **automatic telephony.** (3 800 words & fig.)

1922 625 .13
Engineering, No. 2925, January 20, p. 79.
A new problem in **tunnel ventilation.** (1 800 words.)

1922 625 .112 (.94)
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The Australian railway **gauge question.** (1 600 words.)

1922 621 .33 (.42)
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The **electrification of English** main line railways. (7 000 words.)

Engineering News-Record. (New York.)

1921 656 .211.4 (.73)
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Cleveland public square passenger terminal authorized. (4 800 words & fig.)

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Rectangular enginehouse with interior turntable. (1 400 words & fig.)

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BURN (W. S.). — Direct drive **Diesel-air locomotive.** (3 700 words & fig.)

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Locomotive coal and ash handling plant. (700 words & fig.)

Proceedings, American Society of civil engineers. (New York.)

1921 625 .13
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Tentative specifications for **steel railway bridges.** (18 000 words, tables & fig.)

Railway Age. (New York.)

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The development of the **Robinson connector.** (4 000 words & fig.)

1921 625 .232 (.71)
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New sleeping cars for the Canadian Pacific. (1 800 words & fig.)

1922 656 .253 (.73)
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The Webb **automatic train stop** tested on the Erie. (1 400 words & fig.)

Railway Engineer. (London.)

1922 625 .143.2
Railway Engineer, No. 504, January, p. 2.
Basic Bessemer **steel rails.** (800 words.)

1922 656 .253
Railway Engineer, No. 504, January, p. 2.
Three-position signalling. (800 words.)

1922 625 .143.2
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ALLEN (C. J.). — Basic Bessemer **steel rails.** (4 200 words, 1 table & fig.)

1922 625 .122
Railway Engineer, No. 504, January, p. 34.
Earthwork filling in place of high steel viaducts. (1 300 words & fig.)

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1921 625 .212. (01
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Sandberg sorbitic steel for tyres. (1 800 words & fig.)

1922 621 .13 & 621 .335
Railway Gazette & News, No. 1, January 6, p. 11.
RAVEN (Sir V. L.). — **Railway electrification.** (2 300 words, 5 tables & fig.)

1922 656 .251 (.944)
Railway Gazette & News, No. 1, January 6, p. 15.
Signalling progress on the New South Wales railways. (2 600 words & fig.)

1922 625 .253. (01 (.42)
Railway Gazette & News, No. 3, January 20, p. 87.
Vacuum brake trials on the Great Northern Railway. (1 300 words, 1 table & fig.)

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Railway Gazette & News, No. 3, January 20, p. 89.
The utility of **colour light signals.** (2 500 words.)

Railway Magazine. (London.)

1922 656 .222.1 (.42)
Railway Magazine, No. 296, February, p. 109.
ALLEN (C. J.). — **British locomotive practice** and performance. (5 400 words, tables & fig.)

Railway Maintenance Engineer. (Chicago.)

1922 625 .13 (.73)
Railway Maintenance Engineer, No. 1, January, p. 4.
CORTHELL (A. B.). — **Renewing a bridge** without falsework. (1 000 words & fig.)

1922 625 .151 (.73)
Railway Maintenance Engineer, No. 1, January, p. 13.
Philadelphia & Reading **reclaims frogs** by unique methods. (1 400 words & fig.)

1922 385 .573
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Maintenance of way employees get new national agreement. (3 800 words.)

1922 625 .142.2
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The species of wood used for ties. (1 300 words & 1 table.)

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1922 621 .138.1 (.73)
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FETNER (W. H.). — Roundhouse and shops for Central of Georgia. (1 300 words & fig.)

1922 625. 246
Railway Mechanical Engineer, No. 1, January, p. 27.
SACKETT (H. S.). — The use of wood in freight car construction. (4 100 words, table & fig.)

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1921 621 .132.5 (.73)
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Operating capacity increased with modern motive power. (1 700 words & fig.)

1921 621 .33 (.81)
Railway Review, No. 26, December 24, p. 857.
FORTENBAUGH (S. B.). — Fuel cost key to Paulista Railway electrification. (1 400 words & fig.)

1921 625 .235
Railway Review, No. 27, December 31, p. 893.
Transcontinental comfort in new steel car trains. (2 800 words & fig.)

1922 656 .283 (.73)
Railway Review, No. 1, January 7, p. 10.
Report on the Philadelphia & Reading collision. (5 800 words & fig.)

1922 656 .253 (.73)
Railway Review, No. 2, January 14, p. 39.
Interstate Commerce Commission orders installation of automatic train control. (5 600 words.)

Tramway & Railway World. (London.)

1921 621 .33
Tramw. & Ry. World, No. 30, December 15, p. 317.
STINEMETZ (W. R.). — Electrification. — The future of railways. (2 000 words & fig.)

Transport & Travel Monhtly. (London.)

1922 656 .211
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Passenger termini and passenger terminals. (2 500 words & fig.)

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Electrification of main lines. (4 000 words, table & fig.)

University of Illinois Bulletin. (Urbana.)

1921 62. (0
University of Illinois Bulletin, No. 8, October 24, p. 9
MOORE (H. F.) & KOMMERS (J. B.). — An investigation of the fatigue of metals. (35 000 words, 12 tables fig. & appendices).

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[016 .385. (02]

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1921 62. (01

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Questions de chemin de fer. Etudes commerciales.

Vannes, impr. Lafolye frères et C^ie^; Paris, Léon Eyrolles, éditeur, 3, rue Thénard. In-8°, 208 pages.

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Cours de chemins de fer. Deuxième partie : **Matériel fixe de la voie.**

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1921 625 .143.2 (01

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Essais de réception des rails. Etudes expérimentales de technologie industrielle. (59^e^ mémoire.)

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1921 531. (02

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1922 69 (02

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Statik der Baukonstruktionen. I. Teil : Durchlaufende Träger mit gerader Achse. II. Teil : Bogenträger und Rahmen.

Stuttgart, Verlag von Konrad Wittwer, mit 145 Abbildungen und 12 Zahlenbeispielen. (Preis geb. : 51 Mark.)

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1921 69 (02

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1921 721 .9 (01

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Die Druckfestigkeit von Zementmörtel, Beton, Eisenbeton und Mauerwerk. Die Zugfestigkeit des unbewehrten und bewehrten Betons.

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Der praktische Eisenhochbau.

Berlin, Hermann Meusser. 462 Seiten mit 179 Abbildungen und 38 Zahlentafeln. (Preis, geb. : 350 Mark.)

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Die Natürlichen und Künstlichen Asphalte.

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MAYER (Rudolf), Privatdozent an der Technischen Hochschule in Karlsruhe.

Die Knickfestigkeit.

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Materialprüfungswesen. Einführung in die moderne Technik der Materialprüfungen. II. Teil : Metallprüfung und Prüfung von Hilfsmitteln der Maschinentechnik.

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Annual report for the year ending March 31st 1919.

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Lectures on the Locomotive.

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Railroads of Mexico.

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Practical engineer. — Electrical pocket book and diary.

London, Technical Publishing Co. 23rd year. (5 3/4 × 3 1/2 inches), 610 pages. (Price : 2 s.)

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1921 621 .118 (.44)

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CLAISE. — **Palplanches métalliques** utilisées à la reconstruction des chemins de fer sur la Meuse. (700 mots.)

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1922 725 .33 & 721 .9

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OLLIVIER (G.). — **Réservoirs** en béton armé. (1 200 mots & fig.)

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Wagons frigorifiques à réservoir de saumure. (1 400 mots.)

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La « **fatigue** » **des métaux** soumis à la torsion alternative. (750 mots & fig.)

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1922 313 .385 (.494)

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Statistique des **chemins de fer suisses.** (900 mots.)

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1922 62. (0

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CRÉTIN. — Les **transporteurs aériens à câbles.** (2 50 mots & fig.)

1922 621 .33 (.44) & 625 .4 (.44

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BIETTE (L.). — **Le chemin de fer métropolitain d** Paris. (4 600 mots & fig.)

1922 621 .132.8 (.44

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TARTARY (G.). — **Automotrice** à essence et à deu essieux pour chemins de fer d'intérêt local. (750 mot & fig.)

1922 624 .32 (0

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LÉGENS (L.). — Calcul des **poutres à treillis** doubl avec membrures parallèles et montants verticaux à tou les nœuds d'attache. (2 000 mots & fig.)

1922 624 .62 (.45)

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Pont-rails métallique sur l'Isorno (ligne de Locarn à Domodossola, en Lombardie). (600 mots & fig.)

1922 621 .135.

Génie civil, n° 2063, 25 février, p. 189.

Les bogies et la suspension des locomotives à grand vitesse. (900 mots.)

1922 656 .234. (0

Génie civil, n° 2064, 4 mars, p. 209.

La taxation de la vitesse dans les **transports de voya geurs.** (2 500 mots & fig.)

1922 621 .33 (.81

Génie civil, n° 2065, 11 mars, p. 221.

L'**électrification** du chemin de fer de Paulista (Brésil) (1 800 mots & fig.)

1922 621 .132.8 (.44

Génie civil, n° 2065, 11 mars, p. 226.

Locomotive à essence de 60 chevaux. (900 mots, 1 ta bleau & fig.)

1922 385 .4 (.44

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L'**organisation** du conseil supérieur **des chemins de fer** (350 mots.)

1922 656 .253 (.493

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PAHIN (L.). — **La signalisation** des chemins de fe de l'Etat belge. (3 000 mots & fig.)

1922 624 .32 (.51

Génie civil, n° 2067, 25 mars, p. 265.

MESNAGER. — Concours pour la construction d'u nouveau **pont de chemin de fer** sur le Fleuve Jaun (Chine). (8 200 mots & fig.)

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1922 656 .23 (.44)

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HAGUET (J.). — La revision des **tarifs de transports.** 2 700 mots & tableau.)

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Le relèvement des **tarifs de chemins de fer** dans divers ays d'Europe depuis 1914. (1 000 mots & tableaux.)

1922 385 .14 (.44)

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1922 385. (09.1 (.51)

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Le développement des **chemins de fer chinois** et la rance. (4 300 mots.)

L'Industrie des tramways et chemins de fer. (Paris.)

1921 625 .614

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GAGNÉ. — Technique actuelle de l'**établissement des oies ferrées.** (11 800 mots & fig.)

1921 625 .614 (.44)

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GADOT (P.). — Technique actuelle de l'**établissement es voies ferrées.** (6 000 mots & fig.)

1921 621 .33

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CASTAING. — Normalisation et technique actuelle e la **construction du matériel roulant** pour voies ferrées. 25 000 mots, tableaux & fig.)

1921 621 .33

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JEUSSET. — Alimentation en **énergie électrique** des seaux de traction à courant continu. (6 400 mots, ta- leaux & fig.)

1921 621 .332

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GUERY. — **Distribution de l'énergie électrique** sur s réseaux de traction. (14 000 mots, tableaux & fig.)

1921 621 .33 (.44)

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SEKUTOWICZ & RONZEL. — **L'électrification** des emins de fer secondaires. (22 700 mots, tableaux & fig.)

1922 625 .143.3

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RESAL (E.). — **Usure ondulatoire des rails.** (7 400 ots & fig.)

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1922 385 .6

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PESCHAUD (M.). — Les **chemins de fer dans les accords de l'Allemagne avec la France et la Pologne** et dans le traité entre la France et le gouvernement d'Angora. (3 000 mots & fig.)

1922 625 .253. (01

Revue générale des ch. de fer, n° 2, février, p. 123.

Essais d'un nouveau système de **frein Westinghouse** à double capacité. (8 700 mots, 1 tableau & fig.)

1922 621 .33 (.436)

Revue générale des ch. de fer, n° 2, février, p. 152.

L'**électrification** des chemins de fer autrichiens. (1 000 mots & fig.)

1922 385. (01 (.61)

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La question du **transsaharien.** (2 800 mots.)

1922 621 .133.3

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Nouveaux **tubes à fumée** en hélices. (500 mots & fig.)

1922 621 .335 (.44)

Revue générale des ch. de fer, n° 3, mars, p. 177.

PARODI (H.). — Nouvelles **locomotives électriques** à courant continu 650 volts de 2 000 H.P. de la Compagnie du chemin de fer d'Orléans. (11 800 mots & fig.)

1922 385. (09.1 (.64)

Revue générale des ch. de fer, n° 3, mars, p. 214.

PESCHAUD (M.). — Le **réseau ferré marocain.** (6 000 mots, 1 tableau & fig.)

1922 385 .12 (.44)

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PESCHAUD (M.). — Ratification par les compagnies et mise en vigueur de la convention relative au **nouveau régime des chemins de fer.** (3 400 mots.)

1922 313 .385 (.43)

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Statistique des chemins de fer allemands pour l'exercice 1919-20. (Tableaux.)

Revue politique et parlementaire. (Paris.)

1922 656 .23 (.44)

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ALLIX (G.). — **Tarifs** et exploitation commerciale des chemins de fer. (5 800 mots.)

Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1922 385. (09.1 (.493)

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FRANÇOIS (E.). — Le **chemin de fer Tongres-Aix-la-Chapelle.** (3 000 mots.)

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1922 656 .211.4 (.44) & 656 .257 (.44)

La Science et la vie, n° 60, janvier, p. 19.

BRAZ (H. de). — Les travaux de la **gare Saint-Lazare** et les **signaux électro-pneumatiques.** (4 400 mots & fig.)

1922 625 .212. (01

La Science et la vie, n° 60, janvier, p. 117.

PELLERIN (R.). — La **fabrication des roues de wagons** par la méthode Slick. (2 300 mots & fig.)

1922 625 .251

La Science et la vie, n° 60, janvier, p. 159.

CHAFAUT (C.). — Deux dispositifs pour le **freinage automatique des trains.** (900 mots & fig.)

1922 625 .216 (.44)

La Science et la vie, n° 62, mai, p. 443.

VALCOT (F.). — Avec l'**autocoupleur Boirault,** les wagons s'attellent tout seuls. (2 300 mots & fig.)

Technique moderne. (Paris.)

1922 625 .253. (01

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Essais de **frein à air comprimé** sur trains de marchandises de très fort tonnage [trains de 14 500 tonnes remorquées du Virginian Railway (Etats-Unis.)] (2 400 mots & fig.)

1922 621 .331 (.44)

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EMANAUD (M.) & FOURCAULT (L. D.). — La **supercentrale** de Gennevilliers. (5 000 mots & fig.)

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1922 385 .1

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SAX (E.). — Gegenwart und Zukunft der **Eisenbahnen.** (6 300 Wörter.)

1922 385 .1 (.485)

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FRANKE (G.). — Die Finanzlage der **schwedischen Staatseisenbahnen,** nach den in Deutschland gemachten Erfahrungen beurteilt. (8 800 Wörter & 4 Tabellen.)

1922 385 .6

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MARTIN (O. de). — **Eisenbahnfragen** auf der Konferenz von Portorose. (6 200 Wörter.)

1922 385. (09.1 (.439)

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1922 656 .235 (.47)

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SPODE. — **Die Tarife** der Sowjet-Russischen Eisenbahnen insbesondere die Gütertarife. (9 700 Wörter & Tabellen.)

1922 385 .113 (.494)

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1922 385 .517 (.431)

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KUHATSCHECK (O.). — Die **Arbeiterpensionskasse, die Krankenkassen und die Unfallversicherung** bei den preussisch-hessischen Eisenbahngemeinschaft im Jahr 1919. (9 200 Wörter & Tabellen.)

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1922 656 .222.4

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1922 621 .5

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1922 624. (01

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KOMMERELL. — Welcher Lastenzug soll in Zukunft dem **Baue neuer und zu verstärkender Brücken** zu Grunde gelegt werden? (2 600 Wörter & Abb.)

1922 656 .256

Organ für die Fortschr. des Eisenb., Heft 1, 1. Jan., S. 5.

BECKER (K.). — Die **Blocksperren** mit besonderer Berücksichtigung des **Einheitstellwerkes.** (3 000 Wörter & Abb.)

1922 625 .251

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FÜHR. — Die Frage der **durchgehenden Bremse** für Güterzüge in Frankreich. (2 700 Wörter.)

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ORLEY (L.). — Die massgebende **Arbeitshöhe** der Eisenbahn. (5 300 Wörter & Abb.)

1922 625 .143.1 (.47)

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OPPENHEIM (C.). — Neue 47 kg./m. **schwere Schiene** der russischen Staatsbahnen. (600 Wörter & Abb.)

1922 625 .113
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HAIGIS (G.). — **Gleisbogen** mit stetig verandlichem albmesser. (300 Wörter & 2 Tabellen.)

1922 625 .143.1
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BARKHAUSEN (G.). — Berechnung der **Schienen** auf erschwellen. (2 700 Wörter & Abb.)

1922 621 .39
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BASTÄNIER. — Erfahrungen mit Schweissen durch ektrischen Widerstand in **Eisenbahn-Werkstätten.** 50 Wörter, 1 Tabelle & Abb.)

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1922 624
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BÜHLER (A.). — Ein **Brückenmodell** von Nikolaus ggenbach. (300 Wörter & Abb.)

1922 694
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MEYER (F.). — **Holzkonstruktionen** als Ingenieur- uten. (3 000 Wörter & Abb.)

1922 385. (09.2
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Prof. Dr. h. c. **F. Hennings.** (1 500 Wörter & Bild.)

1922 725 .31 (.494)
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FROELICH (A.). — Neue Aufnahme-Gebäude der **ahnhöfe Brugg** und Augst der S. B. B. (400 Wörter Abb.)

1922 624 .52
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Entwurf für eine **Hängebrücke** von 987 m. Spannweite er den Hudson in New York. (200 Wörter & Abb.)

1922 625 .122
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ROHN (A.). — Beitrag zur Berechnung massiver **aumauern.** (3 000 Wörter & Abb.)

1922 624. (01
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1922 656 .253 (.43)
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JACOBI. — Die **Rangiersignalanlage** in Neudietendorf. 450 Wörter & Abb.)

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SEEGEBRECHT. — Elektrische Fernstellung von **Vorsignalen.** (1 300 Wörter & Abb.)

1922 656 .257
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Auffahrbarer **Drahtzug-Weichenantrieb** mit Zungenüberwachung. (2 300 Wörter & Abb.)

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KOPPIN. — **Organisation und Verwaltung der Reichsbahn** in Preussen. (6 000 Wörter.)

1922 621 .137.1
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BLUMENFELD. — Die Bedeutung der **Streckenkenntnis für den Lokomotivführer** und ihr Erwerb. (1 700 Wörter & Abb.)

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Bull. Amer. Ry. Eng. Ass^{on}, No. 240, October, p. 159.
Report of Committee XV — **Iron and steel structures.** (33 000 words & 3 tables.)

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Report of Committee XXIII — On **shops and locomotive terminals.** (41 000 words, tables & fig.)

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LEFFLER (B. R.). — The flat disk center for turntables. (2 600 words, 2 tables & fig.)

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Report of Committee VI — On buildings. (48 000 words, tables & fig.)

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1922 621 .335 (.83)
Electric Railway Journal, No. 8, February 25, p. 309.
Passenger locomotives for Chilean State Railways. (4 300 words, 4 tables & fig.)

1922 621 .333
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DAY (H. S.). — Expediting armature repair work. (2 600 words, 1 table & fig.)

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MASON (S. E.). — Arc welding in railway shops. (900 words, 1 table & fig.)

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1922 656 .222.1 (.42)
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1922 656 .253
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Automatic train control. (1 400 words.)

1922 621 .132.5 (.460)
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Three-cylinder locomotive for Spanish railways. (1 900 words & fig.)

1922 621 .135 .(01
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BREWER (F. W.). — The development of counterbalancing in British locomotive practice. (2 600 words.)

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The Ramsay condensing turbine electric locomotive. (700 words & fig.)

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1922 656 .2
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ESNOUF (A.) & COUTANCEAU (L. J.). — Th rapid calculation of ferro-concrete beams. (2 500 word 1 table & fig.)

1922 621 .3
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The electrification of main line railways. (1 600 words

1922 621 .3
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WALL (A. T.). — Electric welding. (5 800 wor & fig.)

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The railway situation. (2 400 words.)

1922 621 .131.2 (.42+.7
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DEWHURST (P. C.). — British and American loc motive design and practice. (10 600 words & fig.)

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Arches and the Palm Beach accident. (1 200 words

1922 624 .62 (.7
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AMESBURY (E. G.). — Erection of Hurricane Gul arch bridge in Alaska. (1 900 words & fig.)

1922 624 .63 (.7
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Collapse of Palm Beach concrete arch bridge. (2 0 words & fig.)

1922 624 .61 (.7
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Engineers report collapse due to improper filli method. (500 words.)

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TURNER (C. A. P.). — Open-well piers and subd vided warren trusses of Bismarck-Mandan bridge. (2 6 words & fig.)

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Some features of the Chemung river concrete bridg (2 900 words & fig.)

1922 721
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GIESECKE (F. E.). — Columns and walls lifted swelling clay under floor. (1 200 words & fig.)

1922 691
ngineering News-Record, No. 5, February 2, p. 196.
Cold weather **concreting methods** and equipment. 400 words & fig.)

1922 625 .61 (.42)
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Development of **light railways in Great Britain.** (1 000 rds.)

1922 721 (.73)
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Facts of the Knickerbocker **Theater collapse.** (4 000 rds & fig.)

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Special concrete specified for Jamaica Bay viaduct. 500 words & fig.)

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PROKES (C. A.). — Building a rib-arch **concrete idge** in Arkansas. (2 600 words & fig.)

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Plan to **bridge** Hudson River at Anthony's Nose. 00 words & fig.)

1922 624 .8 (.73)
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New type of **Trunnion bascule bridge** : Wabash ailway. (1 200 words & fig.)

1922 625 .122 (.73)
ngineering News-Record, No. 10, March 9, p. 390.
Railway **ditching machines** and performance records. 800 words, 1 table & fig.)

1922 625 .13 (.52)
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Driving a five-mile rock **tunnel** for Japan Railway. 000 words, 2 tables & fig.)

1922 625 .172 (.71)
ngineering News-Record, No. 10, March 9, p. 399.
HARTON (H. G.). — **Track maintenance** by contract the Canadian Pacific Ry. (2 600 words & fig.)

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Pere Marquette R. R. builds new division **terminal.** 400 words & fig.)

1922 624 .63
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Waterproofing, joints and drainage in concrete bridge. 000 words & fig.)

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HUNLEY (J. B.). — Repairing the rolling parts of vo **bascule bridges.** (2 400 words & fig.)

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TRATMAN (E. E. R.). — **Railway curves** : Super-elevation and maintenance. (3 300 words & 1 table.)

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KELWAY-BAMBER (H.). — Possibilities of improving **train loads.** (4 400 words & 5 tables.)

1922 385. (09.1 (.42)
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PAISH (Sir G.). — The **future of British railways.** (4 800 words.)

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MARSDEN (W. A.). — Some aspects of **transport under private and government control.** (2 600 words.)

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HEDGE (G. T.). — The operation of an important **goods terminal.** (7 500 words.)

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MITCHELL (G.). — **Conveying and elevating machinery.** (3 000 words, tables & fig.)

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WINYARD (T.). — **Railway construction.** Points for new works inspectors. (7 500 words.)

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WHEELER (D.). — **Electrification** of the London & South Western Railway, suburban lines. (6 300 words & fig.)

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WALKER (A.).— **Timber** and its uses. (3 600 words.)

1921 625 .151
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LAWSON (G.). — Tables for **point and crossing work.** (700 words, tables & fig.)

1921 625 .143.3
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BINDLEY (H. D.). — **Rail corrugation.** (6 000 words & fig.)

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Conditions affecting the **head of a rail.** (3 000 words.)

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ABT (S.). — Adhesion and **rack locomotive** for Sumatra. (1 600 words & fig.)

1922 621 .132.8 (.73)
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New Haven using **motor cars** on branch lines. (1 400 words & fig.)

1922 621 .133 (.73)
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Report of the Bureau of **locomotive inspection.** (2 700 words & fig.)

1922 621 .33 (.73)
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Electric traction for steam railroads. (3 000 words.)

1922 624 .8
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A new development in **bascule bridge design.** (1 200 words & fig.)

1922 621 .137.1 (.73)
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Railway Age, No. 8, February 25, p. 462.
TUTAN (G. W.). — An **engine terminal** for economical operation. (2 000 words & fig.)

1922 656. 253 (.73)
Railway Age, No. 9, March 4, p. 517.
The Federal signal Company's **audible signal.** (900 words & fig.)

1922 656. 253 (.73)
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G. R. S. Company's auto-manual **train control.** (1 600 words & fig.)

1922 656 .254 (.7
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RHOADS (S.). — **The telephone** in trunk line ra road service. (1 900 words & fig.)

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JACKMAN (W. T.). — Problem of the Governme **Railways in Canada.** (4 900 words & fig.)

1922 621 .135.2 (.7
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Rolled steel **trailer wheels** for locomotives. (1 0 words & fig.)

1922 621 .
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SCOTT (C. F.). — Effects of **electric power** used f traction. (3 200 words & fig.)

1922 621 .132.8 (.7
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Gasoline motor cars with four-wheel drive. (1 2 words & fig.)

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1922 621 .132.5 (.7
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Mikado type locomotive for the Missouri Pacif Railway. (1 200 words & fig.)

1922 621 .131.1 (.7
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ELMER (W.). — Avoidable waste in the operati of **locomotives and cars.** (2 600 words & fig.)

1922 621 .133 (.7
Railway and Locomotive Engin., No. 2, February, p. 2
Annual report of the chief inspector, Bureau of loc **motive inspection.** (4 800 words & fig.)

1922 621 .132.5 (.7
Railway and Locomotive Engin., No. 2, February, p. 3
Extensive order of **new locomotives** for the Northe Pacific Railway Company. (1 500 words & fig.)

1922 621 .133
Railway and Locomotive Engin., No. 3, March, p. 62.
Expert report on **locomotive boiler welding.** Deta of approved methods of selecting material and perfe ing repairs. (2 400 words & fig.)

Railway Engineer. (London.)

1922 621 .33 (.4
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Railway electrification. (3 200 words, 2 tables & fi

1922 625 .14
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Practical **steel rail specifications.** (1 800 words.)

1922 621 .132.5 (.47)
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LIPETZ (A.). — Russian « Decapod » locomotives. (2 400 words, tables & fig.)

1922 62. (01
Railway Engineer, No. 505, February, p. 55.
The **fatigue of metals.** (1 200 words.)

1922 656 .251(.42)
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Colour light signals. (2 700 words.)

1922 621 .131
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The **steam-booster** for locomotives.(6 200 words & fig.)

1922 621 .133.3 (.42)
Railway Engineer, No. 506, March, p. 105.
Locomotive **boiler accident** at Buxton, London & North Western Railway. (4 000 words & fig.)

1922 625 .144.4 &625 .173
Railway Engineer, No. 506, March, p. 112.
CLOUGHER (N. M.). — Mechanical railway **construction and maintenance.** (5 000 words & fig.)

Railway Gazette & News. (London.)

1922 656 .211.5 (.42)
Railway Gazette & News, No. 5, February 3, p. 177.
Train indicator time-tables at railway stations. (2 000 words & fig.)

1922 621 .33 (.42)
Railway Gazette & News, No. 6, February 10, p. 209.
London, Brighton & South Coast **Railway electrification.** (2 400 words, 1 table & fig.)

1922 621 .13 (.42) & 621 .335 (.42)
Railway Gazette & News, No. 7, February 17, p. 251.
Steam and electric locomotive shunting tests. (400 words & tables.)

1922 656 .212.8 (.42)
Railway Gazette & News, No. 7, February 17, p. 256.
Balancing of railway locomotives. (1 000 words & fig.)

1922 624. (01
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HALL (H. W.). — Ministry of Transport new regulations for the calculation of railway **under bridges.** (1 100 words & 1 table.)

1922 656 .211.4 (.42)
Railway Gazette & News, No. 12, March 24, p. 519.
Royal opening of **Waterloo Station,** London & South Western Railway. (2 700 words & fig.)

1922 625 .143.2
Railway Gazette & News, No. 14, April 7, p. 597.
Rolled **manganese steel rails.** (750 words & fig.)

1922 621 .133.3
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Standard boiler for 2-8-0 type mixed traffic locomotives Great Western Railway. (550 words & fig.)

1922 621 .132.3 (.42) & 625 .232 (.42)
Railway Gazette & News, No. 15, April 14, p. 637.
New **locomotive and rolling stock** developments on the Great Northern. (2 000 words & fig.)

1922 385. (09.1 (.45)
Railway Gazette & News, special issue, April 18, p. 5.
Italian Railways. (10 000 words & fig.)

1922 621 .33 (.45)
Railway Gazette & News, special issue, April 18, p. 73.
Electrification of Italian Railways. (1 000 words & fig.)

1922 656 .223.2 (.42)
Railway Gazette & News, No. 16, April 21, p. 665.
Freight rolling-stock distribution on the Caledonian Railway. (2 900 words & fig.)

1922 625 .212
Railway Gazette & News, No. 18, May 5, p. 735.
A new departure in **tyre rolling.** (900 words & fig.)

1922 656 .211.4 (.42)
Railway Gazette & News, No. 18, May 5, p. 742.
Improvements at **Victoria station,** South Eastern & Chatham Railway. (1 000 words & fig.)

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1922 621 .132.7 (.42)
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GAIRNS (J. F.). — **Shunting locomotives** on British railways. (2 100 words & fig.)

1922 656 .222.1 (.42)
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ALLEN (C. J.). — **British locomotive practice** and performance. (11 700 words, 3 tables & fig.)

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Railway Maintenance Engineer, No. 2, February, p. 44.
ROBINSON (A. F.). — A long experience with **creosoted timber** on the Santa Fe. (3 000 words & fig.)

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Railway Maintenance Engineer, No. 2, February, p. 49.
Getting the **maximum performance** out of **locomotive cranes.** (3 200 words, 1 table & fig.)

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Railway Maintenance Engineer, No. 2, February, p. 57.
Timber treatment promotes economy in maintenance of way. (4 500 words & fig.)

1922 625 .143.4
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Building up **rail ends** with the gas torch. (1 300 words & fig.)

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Railway Maintenance Engineer, No. 3, March, p. 86.
AYLSWORTH (R. G.). — Novel methods feature turntable renewal. (2 200 words & fig.)

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Railway Maintenance Engineer, No. 3, March, p. 91.
SWIFT (E. D.). — Railway crossings should receive more careful attention. (3 200 words & fig.)

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New sleeping and compartment cars for the C. P. R. (3 800 words & fig.)

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JOSEPHS (L. C.). — A practical and powerful gasoline switch locomotive. (1 300 words & fig.)

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ROCHETTE (G. de la). — The foremost French railway electrification project. (3 000 words, 1 table & fig.)

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New railway mail terminal in Chicago. (1 500 words & fig.)

1922 656 .253
Railway Review, No. 10, March 11, p. 351.
The simplex train control system (2 200 words & fig.)

1922 656 .253
Railway Review, No. 10, March 11, p. 353.
The Bourdette-Brookins train control system. (1 500 words & fig.)

1922 621 .132.8
Railway Review, No. 11, March 18, p. 389.
Another advance in gasoline rail car construction. (2 000 words & fig.)

Railway Signal Engineer. (Chicago.)

1922 656 .283 (.73)
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The Bryn Athyn collision on the P. & R. (5 400 words & fig.)

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LASCELLES (T. S.). — Weissenbruch three-position signal system as used in Belgium. (2 400 words & fig.)

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Railway Signal Engineer, No. 3, March, p. 100.
Finnigan automatic train control. (600 words & fig.)

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American train control system. (3 000 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 105.
The General Railway Signal Company system of train control. (3 300 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 109.
The Miller automatic train control. (1 000 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 111.
National safety appliances Company's train control system. (2 800 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 114.
M-V all weather train control. (1 800 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 116.
Regan automatic train control system. (3 500 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 120.
Schweyer automatic train control. (2 300 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 122.
Shadle automatic train signal-stop. (1 300 words & fig.)

1922 656 .254
Railway Signal Engineer, No. 3, March, p. 124.
The Simmen system of speed control and train dispatching. (2 900 words, 1 table & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 128.
Union Switch & Signal Company's automatic train control. (1 900 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 130.
Webb automatic train control. (650 words & fig.)

1922 656 .253
Railway Signal Engineer, No. 3, March, p. 131.
Wooding automatic train control. (2 000 words & fig.)

In Italian.

Giornale del genio civile. (Roma.)

1922 624 .63 (.44)
Giornale del genio civile, 31 gennaio, p. 10.
Importanti progressi in Francia nella costruzione delle grandi volte il ponte di Villeneuve-sur-Lot. (9 500 parole, 4 tabelle & fig.)

1922 624 .3 (.45)
Giornale del genio civile, 31 gennaio, p. 47.
ROSSI (A.). — Ponti economici di cemento armato su canali di Bonifica e Fiumi secondari. (1 300 parole, 1 tabella & fig.)

Rivista dei trasporti. (Milano.)

1922 625 .143.5

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BORINI (G.). — Perfezionamenti alla piastra d'appoggio per gli **armamenti ferroviari.** (1 400 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1922 624 .63

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SANTE PARTANNI. — **Passerella pedonale di cemento armato** a trave continua a tre luci nella stazione di Musocco (Linea Milano-Domodossola). (800 parole & fig.)

1922 385 .15 (.42)

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BELMONTE (L.). — Il nuovo assetto delle **ferrovie britanniche.** (3 300 parole.)

1922 62. (01 & 669 .1

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FORCELLA (P.). — La funzione della **Metallografia** nel razionale impiego dei metalli. (4 000 parole & fig.)

1922 621 .33 (.45)

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Impianto termoelettrico di Torre del Lago **trazione elettrica.** (4 200 parole & tavole.)

1922 656 .229

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MARAVIGNA (D. P.). — **Le ferrovie nella guerra mondiale.** (4 000 parole.)

In Spanish.

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1922 656 .25 (.82)

Boletin de Obras Publicas e Industrias, Enero, p. 5.

BOICHETTA (A. von). — **Señalizacion ferroviaria.** (1 400 palabras & fig.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1922 624 .8

Ingenieur, N^r 5, 4 Februari, p. 76.

DE KOCK VAN LEUWEN (W. J.). — **Breuk van de draaias** eener balans van een **ophaalbrug.** (6 500 woorden, 3 tafereelen & fig.)

1922 62. (01

Ingenieur, N^r 5, 4 Februari, p. 83.

BIEZENO (C. B.). — Over de **berekening van gesloten cirkelvormige ringen** met constante dwarsdoorsnede, die loodrecht op hun vlak belast zijn. (900 woorden & fig.)

1922 385 .3 & 656 .28 (01

Ingenieur, N^r 7, 18 Februari, p. 124.

DUFOUR (L. H. N.). — Onderzoek naar spoorwegongevallen en het **Rijkstoezicht op de spoorwegdiensten.** (1 500 woorden.)

1922 691 (.493)

Ingenieur, N^r 8, 25 Februari, p. 135.

VISSER (Chr. K.). — Verweering van **Belgische steen.** (5 700 woorden, 2 tafereelen & fig.)

1922 621 .33 (.492)

Ingenieur, N^r 9, 4 Maart, p. 151.

VAN LOENEN MARTINET (J. J. W.). — **Electrificatie** van de spoorwegen in Nederland. (13 200 woorden & fig.)

1922 656 .211 (.492)

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DE KANTER (N. M.). — De in uitvoering zijnde wijzigingen in de **spoorwegwerken** te Amsterdam. (4 500 woorden & fig.)

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016 .385. (02]

I. — BOOKS.

In French.

922 385. (02

RDAS (L.), inspecteur du contrôle de l'Etat sur les chemins de fer.

eçons sur les chemins de fer (degré moyen).

'aris (VI[e]), G. Doin, éditeur, 8, place de l'Odéon. 16 (11×8) de 500 pages avec 157 fig. (Prix : 15 fr.)

922 625 .1 (02

URDE (J.).

Ianuel des chemins de fer. Etude de construction.

aris, J. B. Baillière et fils, 19, rue Hautefeuille. 18 (160×105) de 444 pages avec 286 fig.

922 624. (01 & 721. (01

alculs pratiques de constructions métalliques.

ruxelles, A. De Boeck (25×16.5) 110 pages & fig. ix : 8 francs.)

921 692. (02

ARPY (Georges), membre de l'Institut, professeur à l'Ecole nationale supérieure des mines.

onditions et essais de réception des métaux (unifi- on des cahiers des charges).

hartres, impr. Félix Lainé. Paris (VI[e]), Dunod, édi- r, 47 et 49, quai des Grands Augustins. In-8°, xvi-191 es. (Prix net : 15 francs.)

922 621 .39 (02

LAMARRE (E.), ingénieur des arts et métiers, & LEVY (G.), ingénieur des arts et manufactures.

à soudure électrique, ses divers procédés et la pra- ie de leur emploi.

aris (VI[e]), Dunod, éditeur, 47 et 49, quai des Grands- ugustins (21×27) de 80 pages avec 148 fig. (Prix net : trancs.)

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lectrification des réseaux de chemins de fer d'intérêt éral. Propositions du Comité d'études.

aris (VI[e]), Imprimerie Générale Lahure, éditeur, ue de Fleurus. (21×31), de 238 pages, 79 fig. et une e.

1921 532. (02

EYDOUX (D.), professeur à l'Ecole nationale des ponts et chaussées.

Hydraulique générale et appliquée.

Paris, J. B. Baillière. In-8°, 512 pages. (Prix : 40 fr.)

1921 721 .9 (02

FORESTIER (V.).

Le « Portefeuille du béton armé ».

Paris, Dunod, 49, quai des Grands-Augustins. Fascicules 5 à 8. (4 fascicules, 310×210 comprenant ensemble 105 pages autographiées avec 23 fig. et 7 pl.)

1922 721. (01

LIÉVIN (Auguste), ingénieur des arts et manufactures.

Nouvelle méthode de calcul des grandes constructions continues.

Paris, *Le Constructeur de ciment armé*, éditeur, 148, boulevard Magenta. In-8°, 212 pages, 318 fig. (Prix : 20 francs.)

1922 691. (02

MERCIOT (A.), ingénieur civil.

Le ciment armé dans la construction.

Paris, Fanchon, éditeur, 25, rue de Grenelle. Un volume de 899 pages. (Prix : 70 francs.)

1922 669. (02

MICHEL (J.).

Travail des métaux.

Paris, Desforges, 29,quai des Grands Augustins, 2[e] édition, in-12 de viii-355 pages, 153 fig. (Prix : 10 francs.)

1922 669. (01

RICHARDS (Joseph W.), professeur de métallurgie à l'Université de Lehigh (Etats-Unis).

Calculs métallurgiques.

Paris, Dunod, éditeur. (19×28) de xxiv-594 pages. (Prix : 62 francs.)

1922 347 .762

ROGER (René), chargé de cours à la Faculté de droit de Lille, avocat à la Cour d'appel.

Manuel juridique, théorique et pratique des transports.

Paris (VI[e]), Marcel Rivière, Librairie des sciences politiques et sociales, 31, rue Jacob, et 1, rue Saint-Benoît. In-8°, 488 pages. (Prix : 20 francs.)

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[1]) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science," by WEISSENBRUCH, in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1922 313 : 625 .61 (.493) & 625 .61 (08 (.493)

SOCIETE NATIONALE DES CHEMINS DE FER VICINAUX.

Rapports présentés par le Conseil d'administration et par le Comité de surveillance.

37e exercice social, année 1921.

Bruxelles, impr. H. & M. Schaumans, parvis Saint-Gilles, 41. In-4°, 79 pages, 1 carte & tableaux.

1922 531. (01

VIERENDEEL (A.), professeur de stabilité des constructions à l'Université de Louvain.

Introduction à la mécanique rationnelle.

Paris, Dunod, éditeur. Louvain, Uystpruyst, éditeur. In-8°, 180 pages avec 16 fig. (Prix : 18 francs.)

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1922 725 .33 (02

BUFF (C. T.), Dr. Ing.

Werkstattsbau.

Berlin, Verlag Julius Springer. (Preis in Ganzleinen geb. : 125 Mark.)

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DETTMAR (G.), Dr. Ing.

Deutscher Kalender für Elektrotechniker.

München und Berlin, R. Oldenbourg. Hauptband 600 Seiten mit 268 Abb. Ergänzungsband 393 Seiten mit 97 Abb. (Preis zusammen : 52 Mark.)

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DÜRLER (W.), Ober-Elektroingenieur der Rhätischen Bahn, Chur.

Der Abschluss der Elektrifizierung der Rätischen Bahn.

Zürich, Verlag der « Schweizer. Bauzeitung ». A. & C. Jegher, Dianastrasse 5. 20 Seiten, mit 28 Abb. (Preis, geh. : 3 Frank.)

1922 51. (02

EGERER (Heinz).

Ingenieur-mathematik.

Berlin, Julius Springer. 713 Seiten. (Preis : 528 Mark.)

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FISCHER-HINNEN (J.), Professor am Technikum in Winterthur.

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Zürich, Verlag von Albert Raustein, vormals Meyer & Zellers Verlag. Mit 330 Textfiguren. (Preis, geb. : 23 Frank.)

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Elektrische Messtechnik.

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1921 624 .63

KERSTEN (C.), Oberlehrer an der Bangewerksc Berlin.

Brücken in Eisenbeton. Teil I : Platten- und Bal brücken.

Berlin, Wilhelm Ernst & Sohn. Fünfte neubearbei Auflage. 256 Seiten, 605 Textabb. (Preis, geh.: 36 Ma

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LANDSBERG (Th.), Dr. Ing.

Der Brückenbau. Abt. II. Handbuch der Ingeni wissenschaften.

Leipzig, W. Engelmann. Fünfte auflage. (Pre 45 Mark.)

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MÖRSCH (E.), Dr. Ing. e. h., Prof. a. d. Technis Hochschule Stuttgart.

Der Eisenbetonbau, seine Theorie und Anwendun

Stuttgart, Konrad Wittwer. Fünfte vollständig bearbeitete und vermehrte Auflage. Mit 353 Textal dungen. (Preis, geb. : 36 Mark + 20 vH Teueru zuschlag.)

1922 313 .385 (.4

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1921 624 .6

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Neuere Methoden zur Statik der Rahmentragwe Zweiter Band : Der Bogen und das Brückengewölbe.

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Handbook on railways, being the Railways Act,

London, W. C. 2., Sweet & Maxwell, Limited, 3, C cery Lane. (9 3/4×6 1/4 inches), 108 pages. (Pri 5 s. net).

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ASPINALL PARR (G. D.), M. Sc., M. I. E. E.

Electrical engineering testing.

London, Chapman and Hall, Ltd. 4th edition. (Pri 16 s.)

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BECK (Ernest G.).

Real mathematics.

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Metric system for engineers.
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SGROVE (J. F.).
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New York, Simmons-Boardman Publishing Company. ×9 inches), 368 pages.

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A course in electrical engineering. Vol. II. Alternating rents.
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NFIELD (George A.), president and professor of traffic management, Western University of Commerce and Law.
Traffic management.
Portland, Oregon, published by the author. (6×9 1/2 hes), 367 pages.

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RNSTON (Michael H.).
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New York, D. Van Nostrand Co. (8×5 inches), 428 p. liagrams. (Price : $4.)

1922 621 .13 (02
EENLY (Henry), Assc. Inst.-Loco. Eng.
Model steam locomotives. Their details and practical struction.
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1922 669 .1 (02
DFIELD (Sir Robert H.), Bart., D. Sc., D. Met., F. R. S.
The metallurgy of iron and steel; an outline of the velopment of modern practice.
London, Sir Isaac Pitman and Sons, Limited. (Price : 6 d. net.)

1921 651
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Alternating current electrical engineering.
London, Macmillan. 8vo (8 3/4 × 5 3/4 inches), pages. (Price : 17 s. net.)

1922 62. (02
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London, E. C. 4, Crosby Lockwood & Son, 7, Stationers' Hall-court. (Price : 30 s. net.)

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Railway Statistics in Great Britain.
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Manual of Argentine Railways for 1922.
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Materials of construction.
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1922 69. (02 & 72. (02
NOLAN (Thomas), editor-in-chief, professor of architectural construction, University of Pennsylvania, Philadelphia, Pa.
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New York, John Wiley & Sons, Inc. (4 1/2×7 inches), 1 907 pages, illustrated.

1922 621 .3 (01
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Principles of electrical engineering.
New York, John Wiley and Sons, Inc., London, Chapman and Hall, Limited. (Price : 20 s. net.)

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Annales des mines, 3e livraison, p. 159.

Décret, du 11 février 1922, fixant les conditions d'organisation et de fonctionnement du **Conseil supérieur des chemins de fer** et du Comité technique et commercial des chemins de fer. (7 200 mots.)

1922 656 .25 (.44)

Annales des mines, 4e livraison, p. 266.

LEVI (G.). — Note sur les dispositions adoptées pour assurer la **sécurité des trains** sur le réseau d'Alsace-Lorraine. (11 800 mots & fig.)

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FEUILLY (P.) & TOUCHE (E.). — Rapport de la mission envoyée aux Etats-Unis par la Compagnie P.-L.-M. pour l'étude des **grands barrages.** (9 700 mots, tableaux & fig.)

Annales des travaux publics de Belgique. (Bruxelles.)

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CREPLET (L. E.).— Essai sur les **remorques maxima des locomotives à marchandises.** (7 200 mots & tableaux.)

1922 625 .14 (01

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Bull. techn. de la Suisse romande, n° 10, 13 mai, p.

GARDIOL (E.). — Graphique pour l'obtention rap des sections de fer minima, dans une **poutre en bé** armé, soumise à des efforts composés de flexion a compression ou tension. (2 400 mots, 1 tableau & f

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Remplacement du pont métallique de la Paudèze un **viaduc en maçonnerie.** (1 600 mots & fig.)

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1922 624 .2

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RIBERA (J. E.). — **Caissons en béton armé** p fondations à l'air comprimé. (1 100 mots & fig.)

1922 621 .13

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Les **réchauffeurs de l'eau d'alimentation** des loco tives. (4 400 mots & fig.)

1922 624

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CHAUDY (F.). — Effets du passage rapide charges roulantes sur les **poutres maîtresses des po** de chemins de fer. (700 mots & fig.)

1922 625 .14

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Les **ruptures accidentelles des rails.** (1 700 mots & f

922 62. (01
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IESNAGER. — Sur la limite élastique des solides. 00 mots.)

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)ANTIN (Ch.). — Usine hydro-électrique de Fully alais, Suisse), utilisant une chute de 1 650 mètres. 00 mots & fig.)

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Types récents de traverses en béton armé. (1 000 mots.)

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922 621 .133.7
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Réchauffeurs d'eau d'alimentation et pompes alimenres pour locomotives, système Weir. (1 200 mots ig.)

922 625 .122 & 625 .144.4
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VEISS (E.). — Pelle mécanique rotative, système re, pour les travaux de manutention et de terrassent. (2 500 mots & fig.)

922 624 .2 (01
ie civil, n° 2077, 3 juin, p. 494.
)ESCANS (L.). — Le calcul des poutres à diagonales isées. (3 400 mots & fig.)

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922 625 .212
ndustrie des tramw. et ch. de fer, n° 182, févr., p. 41.
VERDOLLIN.— Note sur le reprofilage des bandages. 00 mots & fig.)

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922 625 .212
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Nouveaux bandages en acier sorbitique Sandberg. 200 mots, 2 tableaux & fig.)

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922 385 .3 (.44)
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BERTHELIER. — Les chemins de fer d'intérêt local ès la guerre. (3 200 mots.)

922 385. (09.1 (.436)
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KOLLER (P.). — Trois années d'existence des chens de fer tchécoslovaques. (6 900 mots, 5 tableaux fig.)

922 385 .589 (.43)
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La dernière grève des cheminots allemands. (6 300 mots.)

922 625 .253
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Nouveau système de frein à air comprimé. (2 800 mots & fig.)

922 621 .135.2 (01 & 625 .212. (01
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Traitement des bandages par le procédé Sandberg. (400 mots & fig.)

922 351 .812.4 (.44), 656 .213 (.44) & 656 .236.2 (.44)
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GODFERNAUX (M. R.). — Les embranchements industriels et leur utilité. (14 800 mots, 2 tableaux & fig.)

922 621 .138.5
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Chevalets de 100 tonnes pour le levage des locomotives. (1 700 mots & fig.)

922 385 .6 (.493)
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PESCHAUD (M.). — La question des transports dans l'accord belgo-luxembourgeois. (2 800 mots.)

922 385 .15 (.65)
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922 385 .1 (.494)
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922 669 .1
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HUBERT (H.). — L'acier Stainless. (3 000 mots, 5 tableaux & fig.)

1922 621 .333
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FREIDENBERG (D.). — Note sur la vérification de la **résistance des enroulements triphasés.** (1 800 mots & fig.)

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THOMSON (T.). — **Calcul des poutres** chargées irrégulièrement. (800 mots.)

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Résistance et rendement mécanique **des locomotives.** (1 100 mots & fig.)

1922 621 .332
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AURIC (A.).— Calcul mécanique des **lignes aériennes.** (1 700 mots, 1 tableau & fig.)

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BAULARD (C.). — **Frein électro-pneumatique,** système Baulard. (1 300 mots & fig.)

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KNAUSS (R.). — Die Neuordnung des **französischen Eisenbahnwesens.** (33 000 Wörter & Tabellen.)

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DÖRY (Iwan). — Ueber die Grenzleistung des **phasenbahnmotors** mit Zahnradantrieb. (1 400 Wö & Abb.)

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Der **Brückenbelastungswagen** der S. B. B. (750 Wö & Abb.)

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KINDLER (W.). — Graphikon für die **Berechn von Plattenbalken** und deren wirtschaftliche Bemess bei reiner Biegung. (2 000 Wörter, 2 Tabellen & Abb

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BACHMANN (Th.). — Das Lehrgerüst für die **Ti brücke** Ponte San Giovanni. (500 Wörter & Abb.)

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PASTERNAK (P.). — Beiträge zur Berechnung **Eisenbeton-Querschnitten** auf einheitlicher tabellaris Grundlage. (2 500 Wörter, 1 Tabelle & Abb.)

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RUMMER (J.). — Die Wiederherstellung der **Eisenbrücke** über den Donauarm Borcea in Rumänien. 500 Wörter & Abb.)

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1922 621 .39
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Milwaukee's **powdered coal station**. (6 400 words & fig.)

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WYNNE (F. E.). — **Electric locomotives** for Chile freight service. (2 900 words, 2 tables & fig.)

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Utility **arc welding**. (3 800 words & fig.)

1922 621 .132.3 (.42) & 625 .232 (.42)
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Great Northern Railway-Pacific type **passenger engine**. (1 200 words & fig.)

1922 385. (06.119
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The **International Railway Association**. (1 000 words.)

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New type of **concrete truss bridge**. (1 000 words & fig.)

1922 621 .335
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Battery locomotives for industrial shunting yards. (3 000 words & fig.)

1922 621 .131.2 (.73)
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Locomotive economy. (2 200 words, 1 table & fig.)

1922 621 .132.8 (.44)
Engineer, No. 3461, April 28, p. 476.
A French **petrol locomotive.** (800 words & fig.)

1922 625 .142.2
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A sleeper **creosoting plant.** (1 000 words & fig.)

1922 385. (09.1 (.51)
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1922 656 .23 (.42)
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Railway **rates.** (1 500 words.)

1922 656 .257 (.42)
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Long distance operation of **facing points** on railways. (1 500 words & fig.)

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1 200 H. P. **electric locomotives** for the Metropolitan Railway. (2 500 words & fig.)

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ASPINALL (Sir J. A. F.). — Some post-war **problems of transport.** (6 000 words, 3 tables & fig.)

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HALLER (K.). — Notes on **canal projects** in so western Germany. (1 800 words & fig.)

1922 625 .14
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Steel rails embrittled by **welding bonds.** (600 wo & fig.)

1922 624 .52 (.
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Second railway **cantilever bridge** over « Rever Falls ». (500 words & fig.)

1922 721 .9
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Effects of moisture on behavior of **concrete.** (2 words & 1 table.)

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Two committees charge Kniekerbocker collapse twisting **failure of truss end.** (6 000 words & fig.)

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BLANCHARD (A. C. D.) & YOUNG (R. B.). — P ing 410 000 **Cu. yd. of concrete** on Ontario's Niag power development. (4 300 words & fig.)

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Chicago double-deck **drawbridge** with elevated r way. (2 800 words & fig.)

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Recent practice in **replacing trestles** by earth (1 400 words & fig.)

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STARR (R. C.). — Modern practice in driving w ern hard-rock **tunnels.** (3 200 words, 2 tables & fig.)

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FOGELSTROM (W. J. H.). — Two-hinged timber h used as temporary **railroad bridge.** (1 000 words fig.)

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HALL (F. M.). — Timber struts under compression ke arch thrust during **bridge repair.** (600 words & fig.)

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BJERREGAARD (J. A.). — Caisson with water-llast tanks lays **submerged floor.** (500 words & fig.)

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Load tests of piers for Chicago New Union Station. 200 words & fig.)

1922 625 .144.4
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Applying machinery to railway **maintenance of way.** 100 words.)

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BEANFIELD (R. McC.). — Novel **construction** feat-es on 279-ft. Don Pedro Dam. (3 000 words & fig.)

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Discussion on tentative **specifications for concrete nd reinforced concrete.** (47 000 words, 11 tables & fig.)

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LANG (Ph. G.). — The reconstruction of the **Baltimore and Ohio Railroad bridge** crossing the Allegheny river, at Pittsburgh, Pennsylvania. (7 800 words & fig.)

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Tentative specifications for **steel railway bridges.** (41 000 words, 9 tables & fig.)

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STEINMAN (D. B.). — Locomotive loadings for **railway bridges.** (11 000 words, 4 tables & fig.)

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HENDRICKS (V. K.). — A means of determining the average life of **ties.** (2 100 words, tables & fig.)

1922 625 .254. (01 (.73)
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Vacuum brake tests on English freight trains. (2 600 words & fig.)

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GLISSON (H. B.). — **Bridge slabs** waterproofed before erection. (1 900 words & fig.)

1922 621 .138.1 (.73)
Railway Age, No. 16, April 22, p. 955.
New **locomotive facilities** at Clifton Forge, Va. (2 300 words & fig.)

1922 656 .259 (.73)
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The Sprague system of auxiliary **train control.** (3 000 words & fig.)

1922 621 .335 (.83)
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1922 385. (09.1 (.725)
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FOSS (Ch. W.). — **Mexican railways** prepared for improved business. (4 000 words & fig.)

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Railway Age, No. 18, May 6, p. 1063.
A new **timber treating plant** at Minneapolis. (1 800 words & fig.)

1922 621 .132.8 (.73)
Railway Age, No. 18, May 6, p. 1069.
New features in service railway **motor coach.** (1 000 words & fig.)

1922 624 .63 (.73)
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Rebuilding of Galveston causeway nearly complete. (2 500 words & fig.)

1922 625 .244
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WINTERROWD (W. H.). — Some notes on railway **refrigerator cars.** (2 000 words & fig.)

1922 624 .52 (.71)
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New **cantilever bridge** replaces famous old span. (1 200 words & fig.)

1922 621 .132.8 (.485) & 621 .43 (.485)
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Diesel-electric motor cars for railway service. (900 words & fig.)

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1922 656 .255 (.42)
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Unlocking the **starting signal** for entering a single line section by the tablet. (1 000 words & fig.)

1922 624 (.54)
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Railway bridges in Burma. (2 000 words & fig.)

1922 656 .253 (.42)
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All-electric automatic **power signalling** on the Metropolitan Railway. (1 600 words.)

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The wiring, etc., of the **train control system** of the North British Railway. (900 words & fig.)

1922 621 .132.3 (.42)
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Three-cylinder 4-6-2 locomotive, Great Northern Railway. (1 200 words & fig.)

1922 621 .132.8
Railway Engineer, No. 508, May, p. 181.
Recent « Garratt » patent **locomotives.** (2 700 words & fig.)

1922 621 .138.2 (.73)
Railway Engineer, No. 508, May, p. 193.
Reinforced concrete locomotive **coaling and sanding plants.** (800 words & fig.)

1922 621 .132.8 & 621 .335
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New development in **locomotive practice.** (700 words & fig.)

1922 625 .
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Railway **turntables.** (1 600 words & fig.)

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1922 656 .212 (.
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Feltham **concentration yard,** London & South West
Railway. (3 600 words & fig.)

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« **Parallel** » **traffic working** on the South Eastern
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Revue générale des ch. de fer, n° 6, juin, p. 480.

Les deux derniers **relèvements des tarifs** de chem de fer en Autriche. (2 800 mots & 3 tableaux.)

1922 621 .131.3 (.42) & 621 .335 (.

Revue générale des ch. de fer, n° 6, juin, p. 488.

Essais de **locomotives de manœuvre à vapeur** et é triques sur le London Brighton Ry. (500 mots.)

1922 625 .251 (.

Revue générale des ch. de fer, n° 1, juillet, p. 3.

TRONCHERE (L.). — Une application du **frein c** tinu aux trains de marchandises en Tunisie. (4 000 m & fig.)

1922 385 .113 (.

Revue générale des ch. de fer, n° 1, juillet, p. 12.

PESCHAUD (M.). — Les **résultats de l'exploitat** des cinq grandes compagnies de chemins de fer en 1 (8 200 mots & 13 tableaux.)

1922 385 .4 (.

Revue générale des ch. de fer, n° 1, juillet, p. 28.

PESCHAUD (M.). — **L'organisation administra** des chemins de fer allemands. (3 600 mots & fig.)

1922 385 .113 (.

Revue générale des ch. de fer, n° 1, juillet, p. 36.

Résultats obtenus en 1920 sur le réseau des chem de fer de l'Etat en France d'après les comptes d'ad nistration publiés pour ladite année. (1 800 mot 12 tableaux.)

1922 385 .113 (.44)
Revue générale des ch. de fer, n° 1, juillet, p. 55.
Les résultats d'exploitation du réseau des chemins de fer de l'Etat en 1920. (2 300 mots & 1 tableau.)

Revue universelle des mines, de la métallurgie, des travaux publics, des sciences et des arts appliqués à l'industrie. (Liége.)

1922 62. (01 & 669
Revue universelle des mines, n° 1, 1er juillet, p. 1.
GUILLET (L.). — Les récents progrès de la métallographie microscopique et de la macrographie. (8 000 mots.)

La Science et la Vie. (Paris.)

1922 625 .242
La science et la vie, n° 63, juillet, p. 67.
LORDIER (Ch.). — Les wagons à grande capacité pour le transport des charbons et des minerais. (4 000 mots & fig.)

1922 656 .212.6
La science et la vie, n° 63, juillet, p. 137.
SEJOURNET (R. R.). — La manutention rapide et économique par le chariot électrique. (1 800 mots & fig.)

Technique moderne. (Paris.)

1922 625 .252
Technique moderne, n° 6, juin, p. 272.
Nouvel appareil de réglage des timoneries de freins permettant de maintenir constant, malgré l'usure, le jeu des sabots de freinage. (900 mots & fig.)

In German.

Glasers Annalen. (Berlin.)

1922 621 .132 (.431)
Glasers Annalen, Heft 11, 1. Juni, S. 192.
HAMMER (G.). — Die neuen Lokomotiven der Halberstadt - Blankenburger Eisenbahn - Gesellschaft. (6 300 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens (Berlin und Wiesbaden.)

1922 656 .212.5
Org. für die Fortschr. des Eisenb., H. 8, 15. April, S. 111.
POESENTRUP. — Mittel zur Erhöhung der Leistung der Ablaufberge. (2 600 Wörter & Abb.)

1922 625 .142
Org. für die Fortschr. des Eisenb., H. 8, 15. April, S. 114.
RAUSCHENBERGER (A.). — Versuche der Südbahn mit Schwellen aus bewehrtem Grobmörtel. (450 Wörter & Abb.)

1922 625 .232 (.43)
Org. für die Fortschr. des Eisenb., H. 8, 15. April, S. 114.
Der neue Schlafwagen III. Klasse. (800 Wörter & Abb.)

1922 621 .33 (.43)
Org. für die Fortschr. des Eisenb., H. 9, 1. Mai, S. 127.
GLEICHMANN. — Die elektrische Zugförderung auf den deutschen Reichsbahnen. (5 000 Wörter.)

1922 385 .57
Org. für die Fortschr. des Eisenb., H. 9, 1. Mai, S. 132.
SODER. — Aus der Praxis des Gedingeverfahrens. (3 000 Wörter.)

Schweizerische Bauzeitung. (Zürich.)

1922 351 .81 (.43 + .44 + .494)
Schweizerische Bauzeitung, Nr. 22, 3. Juni, S. 275.
Die Lösung der Rheinfrage. (3 400 Wörter & Abb.)

1922 624 .5
Schweizerische Bauzeitung, Nr. 1, 1. Juli, S. 1.
KIHM (K.). — Versteifte Balkenbrücken. (3 000 Wörter & Abb.)

1922 624 .2
Schweizerische Bauzeitung, Nr. 1, 1. Juli, S. 8.
Parallelflanschige Breitflansch-Träger. (500 Wörter.)

1922 721 .9
Schweizerische Bauzeitung, Nr. 2, 8. Juli, S. 11.
HERZKA (L.). — Eisenbetonmaste mit Rechteckquerschnitt. (1 600 Wörter, 1 Tabelle & Abb.)

1922 621 .335 (.494)
Schweizerische Bauzeitung, Nr. 2, 8. Juli, S. 13.
Einphasen-Schnellzuglokomotiven 2-C-1 mit Einzelachsantrieb Bauart Brown Boveri. (2 700 Wörter & Abb.)

1922 531. (01
Schweizerische Bauzeitung, Nr. 3, 15. Juli, S. 23.
POESCHL (Th.). — Zur Frage der Stabilität rotierender Wellen. (2 300 Wörter & Abb.)

1922 625 .142 .3
Schweizerische Bauzeitung, Nr. 4, 22. Juli, S. 42.
BIRK (A.). — Eiserne Hohlschwelle, Bauart Scheibe. (2 000 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

1922 656 .254
Zeitschr. f. das ges. Eis.-Sicher., Nr. 12, 10, Juni, S. 57.
KLOTZ. — Isolierter Draht in Fernmeldeanlagen. (2 000 Wörter & Abb.)

1922 656 .25 (.431)
Zeitschr.f. das ges. Eisenb.-Sicher., Nr. 13, 10. Juli, S. 65.
RONDOLF. — Die Stromversorgung der elektrischen Sicherungsanlagen der Berliner Stadtbahn. (2 000 Wörter & Abb.)

Zeitschrift des Vereines deutscher Ingenieure. (Berlin.)

1922 **62. (01**

Zeitschr. Ver. deutsch. Ing., Nr. 23, 10. Juni, S. 566.

RIEDEL (F.). — **Die Rutschkegelbildung als Grundlage für das Materialprüfwesen.** (6 200 Wörter, 1 Tabelle & Abb.)

1922 **669 .1**

Zeitschr. Ver. deutsch. Ing., Nr. 24, 17. Juni, S. 606.

WENDT (K.). — **Konstruktionsforderungen und Eigenschaften des Stahles.** (9 000 Wörter, 13 Tabelle & Abb.)

In English.

American Machinist. (London.)

1922 **621 .7 (.73)**

American Machinist, No. 17, June 17, p. 613.

ASHTON HAND (S.). — **Special tools and fixtures in a southern railroad shop.** (2 000 words & fig.)

Bulletin, American Railway Engineering Association. (Chicago.)

1922 **625 .143**

Bull. Amer. Ry. Eng. Ass., No. 243, January, p. 621.

Report of Committee IV. **On rail.** (18 000 words, tables & fig.)

1922 **385 .573 & 625 .14 (01**

Bull. Amer. Ry. Eng. Ass., No. 243, January, p. 669.

Report of Committee XXII. **On economics of railway labor.** (14 400 words & tables.)

1922 **624. (01**

Bull. Amer. Ry. Eng. Ass., No. 243, January, p. 706.

Report of Committee VII. **Wooden bridges and trestles.** (6 500 words & fig.)

1922 **385 .111 (.73)**

Bull. Amer. Ry. Eng. Ass., No. 243, January, p. 727.

Report of Committee XXI. **On economics of railway operation.** (18 600 words, tables & fig.)

Electric Railway Journal. (New York.)

1922 **621 .331 (.73)**

Electric Railway Journal, No. 22, June 3, p. 897.

Calumet station adds 180 000 kw. to generating capacity of Chicago Company. (2 900 words & fig.)

1922 **621 .33 (.44)**

Electric Railway Journal, No. 23, June 10, p. 923.

CHARPENTIER (P.) & BILL (E. M.). — **France making real progress in electrification.** (2 700 words & fig.)

1922 **625 .212. (01**

Electric Railway Journal, No. 24, June 17, p. 939.

RICHARDSON (G. A.). — **Manufacturing rolled steel wheels.** (2 600 words & fig.)

1922 **621 .337 (.73)**

Electric Railway Journal, No. 25, June 24, p. 991.

HUTCHISON (W. M.). — **Control equipments for Pacific Electric Railway.** (3 000 words, table & fig.)

Electric Railway and Tramway Journal. (London.)

1922 **621 .33 (.45)**

Electric Ry. & Tramw. Journal, No. 1136, June 16, p. 273.

DONATI (A.). — **Railway electrification in Italy.** (3 600 words, 2 tables & fig.)

1922 **621 .33 (.44)**

Electric Ry. & Tramw. Journal, No. 1136, June 16, p. 278.

SABOURET (M.). — **Electrification in France.** (2 200 words & fig.)

1922 **621 .33 (.492)**

Electric Ry. & Tramw. Journal, No. 1136, June 16, p. 291.

Railway electrification in Holland. (3 000 words, 1 table & fig.)

Engineer. (London.)

1922 **621 .132.6 (.42)**

Engineer, No. 3468, June 16, p. 660.

Glasgow & South-Western Railway Baltic type tank engines. (1 500 words & fig.)

1922 **621 .335**

Engineer, No. 3468, June 16, p. 672.

RAVEN (Sir Vincent L.). — **Electric locomotives.** (5 600 words, 8 tables & fig.)

1922 **621 .118 (.42) & 621 .134.1 (.42)**

Engineer, No. 3469, June 23, p. 698.

The East Horndon locomotive failure. (4 500 words.)

1922 **621 .33 (.83)**

Engineer, No. 3470, June 30, p. 711.

Electrification of the Chilean State Railways. (4 400 words, 1 table & fig.)

1922 **656 .253 (.42)**

Engineer, No. 3470, June 30, p. 720.

The report of the automatic train control Committee. (2 500 words.)

1922 **656 .253**

Engineer, No. 3470, June 30, p. 723.

Automatic train control. (1 700 words.)

1922 **656 .25 (.42)**

Engineer, No. 3471, July 7, p. 16.

The re-signalling of the Mersey Railway. (2 500 words & fig.)

1922 **625 .1 (.42)**

Engineer, No. 3472, July 14, p. 32.

The Chalk Farm widening, L. and N. W. Rly. (1 200 words & fig.)

Engineering. (London.)

1922 621 .335

Engineering, No. 2947, June 23, p. 795.

RAVEN (Sir Vincent L.). — **Electric locomotives.** (9 400 words, tables & fig.)

1922 621 .133.7

Engineering, No. 2947, June 23, p. 801.

SAUVAGE (Ed.). — **Feed-water heaters for locomotives.** (2 400 words & fig.)

1922 656 .253

Engineering, No. 2948, June 30, p. 819.

Train control. (1 800 words.)

1922 621 .33

Engineering, No. 2949, July 7, p. 1.

THORMANN (L.). — Choice of a system for **electric traction** on main line railways. (4 500 words & 1 table.)

1922 621 .132.8 (.485)

Engineering, No. 2951, July 21, p. 64.

The Ljungström turbine locomotive. (4 500 words & fig.)

Locomotive, Railway, Carriage and Wagon Review. (London.)

1922 621 .132.3 (.42)

Loc. Ry. Carr. & Wagon Review, No. 359, July 15, p. 187.

Great Central Railway **locomotives for burning pulverized coal and colloidal fuel.** (2 200 words & fig.)

1922 621 .132.6 .42)

Loc. Ry. Carr. & Wagon Review, No. 359, July 15, p, 194.

New passenger tank locomotives, Glasgow and South Western Ry. (2 400 words & fig.)

Mechanical Engineering. (New York.)

1922 625 .244

Mechanical Engineering, No. 7, July, p. 419.

WINTERROWD (W. H.). — Some notes on railway **refrigerator cars.** (5 500 words, 3 tables & fig.)

1922 621 .116. (01

Mechanical Engineering, No. 7, July, p. 427.

COTTON (A.). — The accuracy of **boiler tests.** (4 000 words & fig.)

1922 621 .118

Mechanical Engineering, No. 7, July, p. 438.

UEHLING (E. A.). — **The control of boiler operation.** (5 200 words, 2 tables & fig.)

Proceedings, American Society of civil engineers. (New York.)

1922 721 .1 (01

Proceed. Amer. Soc. civil engin., Vol. CCXII, p. 369.

HUMMEL (F. H.) & FINNAN (E. J.). — The distribution of **pressure on surfaces supporting a mass of granular material.** (6 000 words, 7 tables & fig.)

Proceedings, Institution of Civil Engineers (London.)

1921 625 .142.3 (.62)

Proceedings, Institut. of Civil Eng., vol. CCXII, p. 366.

BERESFORD ST. GEORGE VERSCHOYLE. — Permanent way on **steel sleepers.** (350 words & fig.)

Proceedings, Institution of Railway Signal Engineers. (Manchester.)

1921 656 .256

Proceedings, Inst. of Ry. Signal Eng., p. 40.

GALL (D. C.). — Fundamental calculations of **A. C. track circuit.** (12 000 words, tables & fig.)

1921 656 .253

Proceedings, Instit. of Ry. Signal Engin., p. 165.

THORROWGOOD (W. J.). — Problems of **automatic train control.** (6 500 words.)

1921 656 .253

Proceedings, Instit. of Ry. Signal Engin., p. 248.

TATTERSALL (A. E.). — **Three-position signalling.** (4 000 words & fig.)

1921 656 .253

Proceedings, Instit. of Ry. Signal Engin., p. 272.

SADLER (W. J.). — **Light signals.** (3 000 words.)

Railway Age. (New York.)

1922 625 .13 (.73)

Railway Age, No. 21, May 27, p. 1215.

Double-track spans placed on single-track piers. (3 500 words & fig.)

1922 625 .244

Railway Age, No. 21, May 27, p. 1229.

WINTERROWD (W. H.). — Some notes on railway **refrigerator cars.** (3 900 words, 1 table & fig.)

1922 625 .13 (.73)

Railway Age, No. 22, June 3, p. 1275.

Mc FETRIDGE (W. S.). — **Converting a tunnel** into an open cut on a busy line. (2 000 words & fig.)

1922 624 .1 (.73) & 721 .1 (.73)

Railway Age, No. 22, June 3, p. 1281.

Pile jetting tests show unusual results. (600 words & fig.)

1922 621 .133.2

Railway Age, No. 22, June 3, p. 1291.

The development of welded flexible **staybolts.** (1 000 words & fig.)

1922 621 .132.3 (.73)

Railway Age, No. 23, June 10, p. 1325.

A mountain type locomotive for high capacity. (2 400 words & fig.)

1922 625 .13 (.73)

Railway Age, No. 23, June 10, p. 1333.

CLEMENTS (M. F.). — **Shifting of bridge pier** stopped after 35 years. (2 800 words & fig.)

1922 656 .212.5 (.73)
Railway Age, No. 24, June 17, p. 1467.
New Haven builds **freight yards** at Providence. (2 300 words & fig.)

1922 621 .333 (.73)
Railway Age, No. 24, June 17, p. 1477.
SMITH (W. H.). — New **single phase equipment** for the New Haven. (1 500 words & fig.)

1922 625 .144.2 (.73)
Railway Age, No. 1, July 1, p. 7.
Aurora **track elevation** expedites traffic. (2 600 words & fig.)

1922 621 .132.8
Railway Age, No. 1, July 1, p. 17.
BEAN (W. L.). — Developments in **gasoline passenger rail cars.** (4 200 words, 2 tables & fig.)

1922 656 .211.4 (.73)
Railway Age, No. 2, July 8, p. 63.
Comprehensive report on St. Louis **Terminals.** (3 600 words & fig.)

1922 621 .133.1 & 656 .222.1
Railway Age, No. 2, July 8, p. 71.
DAVENPORT (J. E.). — Effect of tonnage and speed on **fuel consumption.** (2 800 words, 1 table & fig.)

1922 656 .281 (.73)
Railway Age, No. 2, July 8, p. 77.
Disastrous **derailment** at Winslow Junction, N. J. (1 000 words & fig.)

1922 656 .253 (.73)
Railway Age, No. 25, June 24, p. 1739.
Train control ordered on forty-nine roads. (5 800 words.)

Railway Engineer. (London.)

1922 625 .151 & 625 .143.3
Railway Engineer, No. 509, June, p. 206.
The life of **switches and crossings.** (1 500 words.)

1922 621 .132.3 (.42)
Railway Engineer, No. 509, June, p. 219.
Three-cylinder « Pacific » type express locomotive, North Eastern Railway. (600 words & fig.)

1922 656 .257
Railway Engineer, No. 509, June, p. 221.
Long-distance **operation of facing points.** (1 800 words & fig.)

1922 624 .7 (.42)
Railway Engineer, No. 509, June, p. 224.
New **bridge** at Kilkewydd, Cambrian Railways. (500 words & fig.)

1922 656 .221
Railway Engineer, No. 509, June, p. 225.
Train resistance. (2 400 words, 2 tables & fig.)

1922 621 .132.6 (.42)
Railway Engineer, No. 509, June, p. 232.
New « Baltic » type **tank engine,** London, Brighton & South Coast Railway. (500 words & fig.)

1922 656 .28 (01
Railway Engineer, No. 509, June, p. 229.
An analysis of ten years' **railway accidents.** (4 000 words.)

1922 621 .335 (.42) & 621 .338 (.42)
Railway Engineer, No. 510, July, p. 255.
New stock for Tynemouth electrified branches, North Eastern Railway. (1 800 words & fig.)

1922 656 .253
Railway Engineer, No. 510, July, p. 274.
Location of signals as an aid to traffic working. (4 000 words & fig.)

Railway Gazette & News. (London.)

1922 621 .132.6 (.42)
Railway Gazette & News, No. 24, June 16, p. 961.
New « Baltic » **tank engine,** Glasgow & South Western Railway. (400 words & fig.)

1922 656 .212.6 (.42)
Railway Gazette & News, No. 24, June 16, p. 962.
Electric trucks in goods terminal work. (3 000 words & fig.)

1922 385 .113 (.42)
Railway Gazette & News, No. 24, June 16, p. 970.
British railways in 1921. (1 800 words & 3 tables.)

1922 625 .122 & 625 .144
Railway Gazette & News, No. 25, June 23, p. 993.
Crane navy for railway work. (600 words & fig.)

1922 625 .245 (.73)
Railway Gazette & News, No. 25, June 23, p. 1000.
Glass-lined tanks for milk traffic. (200 words & fig.)

1922 625 .216
Railway Gazette & News, No. 25, June 23, p. 1001.
The « Mackelson » **automatic coupler.** (500 words & fig.)

1922 621 .133.1 (.83)
Railway Gazette & News, No. 26, June 30, p. 1030.
REVILL (W. H.). — **Oil fuel for locomotives** on the Taltal Railway of Chile. (1 800 words, 5 tables & fig.)

1922 621 .33 (.42)
Railway Gazette & News, No. 1, July 7, p. 9.
Electrification of suburban lines, London & North Western Railway. (2 300 words & fig.)

1922 621 .132.6 (.92)
Railway Gazette & News, No. 1, July 7, p. 18.
New 4-6-4 type tank engines for Java. (900 words & fig.)

1922 385 .52 (.42)
Railway Gazette & News, No. 3, July 21, p. 82.
The fall in railway wages. (2 200 words.)

1922 656 .253 (.42)
Railway Gazette & News, No. 3, July 21, p. 86.
The re-signalling of the Mersey Railway. (2 300 words & fig.)

1922 621 .131.3 (.42)
Railway Gazette & News, No. 3, July 21, p. 90.
New « Baltic » tank locomotives, Glasgow & South Western Railway. (1 700 words & fig.)

Railway Magazine. (London.)

1922 621 .132.3 (.42)
Railway Magazine, No. 301, July, p. 25.
British « Pacific » locomotives compared. (800 words & fig.)

1922 656 .222.1 (.42)
Railway Magazine, No. 301, July, p. 37.
ALLEN (C. J.). — British locomotive practice and performance. (3 800 words, 4 tables & fig.)

Railway Review. (Chicago.)

1922 656 .253 (.73)
Railway Review, No. 18, May 6, p. 627.
Freight train tests of train control on the C. I. & W. R. R. (1 000 words & fig.)

1922 624 .62 (.73)
Railway Review, No. 18, May 6, p. 638.
Erection of Hurricane Gulch arch bridge on Alaska Government Railway. (700 words & fig.)

1922 621 .132.8 (.73)
Railway Review, No. 19, May 13, p. 669.
The power behind the modern gasoline motor rail car. (2 500 words & fig.)

1922 625 .216
Railway Review, No. 19, May 13, p. 679.
The Hall multiplate friction draft gear. (1 100 words, table & fig.)

1922 621 .138.2 (.42)
Railway Review, No. 20, May 20, p. 709.
Modern English coal and ash handling plants. (1 000 words & fig.)

1922 621 .132.8
Railway Review, No. 21, May 27, p. 741.
BEAN (W. L.). — Some recent developments in gasoline motor rail cars. (5 000 words, 1 table & fig.)

1922 656 .253
Railway Review, No. 21, May 27, p. 747.
The Sprague system of automatic train control (10 000 words & fig.)

1922 621 .133.1
Railway Review, No. 22, June 3, p. 777.
DAVENPORT (J. E.). — Effect of tonnage rating and speed on fuel consumption. (3 900 words & fig.)

1922 621 .133.1
Railway Review, No. 22, June 3, p. 782.
BASFORD (G. M.). — Locomotive fuel. The life blood of transportation. (3 400 words & fig.)

1922 621 .133.3
Railway Review, No. 22, June 3, p. 787.
LISTER (F. G.). — Effect of circulation on locomotive boiler efficiency. (4 600 words.)

1922 621 .132.3 (.73)
Railway Review, No. 23, June 10, p. 815.
Union Pacific mountain type locomotive No. 7 000. (4 600 words & fig.)

1922 621 .133.7
Railway Review, No. 23, June 10, p. 825.
Practical advantages of locomotive feed water heating. (3 500 words & fig.)

1922 625 .215
Railway Review, No. 23, June 10, p. 831.
The latest development in 6-wheel passenger trucks. (1 200 words & fig.)

1922 625 .242 (.73)
Railway Review, No. 23, June 10, p. 834.
How the C. M. & St. P. R. R. designed their new gondola cars. (4 600 words & fig.)

1922 625 .242 (.73)
Railway Review, No. 23, June 10, p. 841.
A 70-ton all steel gondola with clasp brake equipment. (1 700 words & fig.)

1922 625 .213
Railway Review, No. 23, June 10, p. 844.
CHILES (G. S.). — Spring assemblages for freight car trucks. (2 800 words & fig.)

1922 625 .244
Railway Review, No. 23, June 10, p. 850.
WINTERROWD (W. H.). — The insulation of railway refrigerator cars. (1 800 words, tables & fig.)

1922 725 .4 (.73)
Railway Review, No. 24, June 17, p. 889.
A. T. & S. F. Ry. shop improvements at Albuquerque. (2 900 words & fig.)

1922 621 .133.3
Railway Review, No. 24, June 17, p. 900.
LEDACS KISS (D.). — Development of a practical water tube locomotive firebox. (3 800 words & fig.)

1922 621 .7 (.73)
Railway Review, No. 24, June 17, p. 913.
RICHARDSON (G. A.). — Equipment and operation of a modern steel car plant. (3 200 words & fig.)

1922 625 .215
Railway Review, No. 24, June 17, p. 918.
A one piece wrought steel truck side frame. (1 600 words & fig.)

1922 621 .132.8

Railway Review, No. 24, June 17, p. 930.

PLANT (L. G.). — What is the future for **automotive rail cars**? (2 800 words, 1 table & fig.)

1922 621 .132.8

Railway Review, No. 24, June 17, p. 934.

120 H. P. gasoline motor features new rail car design. (1 600 words, 1 table & fig.)

Railway Signal Engineer. (Chicago.)

1922 656 .253 (.73)

Railway Signal Engineer, No. 6, June, p. 221.

STOLTZ (C. F.). — New **signaling** on the Big Four. (2 500 words & fig.)

1922 656 .259

Railway Signal Engineer, No. 6, June, p. 224.

VIEILLARD (L. F.). — A new **phase-angle meter.** (1 200 words & fig.)

1922 656 .253

Railway Signal Engineer, No. 6, June, p. 226.

The Sprague **train control system.** (3 600 words & fig.)

1922 656 .253

Railway Signal Engineer, No. 6, June, p. 231.

BAXTER (S. L.). — Introducing economies in **signal operation.** (1 300 words & fig.)

Transport & Travel Monthly (London.)

1922 621 .138.2 (.42)

Transport & Travel Monthly, No. 144, April, p. 254.

Coal and ash plant at Willesden locomotive depot. (1 400 words & fig.)

1922 621 .131.3 (.42)

Transport & Travel Monthly, No. 147, July, p. 23.

Trial run of new 4-6-4 express tank engine No. 544. (2 300 words & fig.)

In Italian.

Giornale del genio civile. (Roma.)

1922 721 .9 (01

Giornale del Genio Civile, 31 Maggio, p. 283.

STABILINI (L.). — Sulla flessione deviata nelle **travi di cemento armato.** (1 500 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.

1922 385 .11 (.45

Rivista tecnica delle ferrovie, No. 5, 15 Maggio, p. 173.

LANINO (P.). — **Costo e prodotto dell' asse-chil metro** sulle Ferrovie italiane dello stato. (1 300 paro & fig.)

1922 621 .332 (.45) & 624 .8 (.

Rivista tecnica delle ferrovie, No. 5, 15 Maggio, p. 178.

VALLECCHI (G.). — Dell' impianto tramviario s **ponte girevole** di Taranto. (5 000 parole & fig.)

1922 656 .212.6 (.45

Rivista tecnica delle ferrovie, No. 6, 15 Giugno, p. 205.

BRUZZESI (E. G.). — **L'arredamento del porto** Livorno. (5 400 parole & fig.)

1922 624 .63 (.45

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Monthly Bibliography of Railways [1]

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[016 .385. (02]

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An American highway suspension bridge. (900 words fig.)

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RISDON (J. P.). — Riachuelo transporter bridge, Jenos Aires. (3 500 words & fig.)

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SPACKMAN (H. S.). — Alumina cement; its development, use and manufacture. (4 300 words.)

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McCULLOUGH (C. B.). — Large steel arch bridge ribs encased in gunite. (2 200 words & fig.)

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Failure of concrete arch bridge due to pier washout. (500 words & fig.)

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RUSSELL (F. V.). — The operation of heavy su **ban passenger services** on a steam railway, with p cular reference to density of service, terminal and c facilities. (22 400 words & fig.)

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ROBINSON (J. G.). — The use of **pulverised and colloidal fuel** on the Great Central Railway. (1 words & fig.)

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HALES (W. P.). — **Rail-creep.** (700 words & fig.

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LEA (F. Ch.). — The effect of temperature on modulus of elasticity and other **properties of me** (3 600 words & fig.)

1922 623 (
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LYELL (D.). — The work done by **railway troop** France during 1914-19. (23 000 words & fig.)

1922 623 (
Proceed., Institut. of Civil Eng., vol. CCX, part II, p.
ROBERTSON (J. K.). — Richborough **military tr portation depot.** (18 500 words, 11 tables & fig.)

1922 62.
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STANTON (T. E.) & BATSON (R. G. C.). — On characteristics of notched-bar **impact tests.** (8 200 wo 9 tables & fig.)

1922 62.
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GREAVES (R. H.) & MOORE (H.). — Notes on single-blow **impact test** on notched bars. (3 000 wo 12 tables & fig.)

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922 62. (01
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ADFIELD (Sir Robert A.) & MAIN (S. A.). — ck tests and their standardization (6 000 words & ble.)

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LLSON (G.). — Cannon street bridge strengthening. 00 words, fig. & appendix.)

922 625 .13 (.81)
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AYLOR (J. H.). — The application of electric trac- to the suburban lines of the Central Argentine lway. (8 900 words.)

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LLLIE (G. E.). — Permanent way on mountain rail- ys. (5 900 words & fig.)

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DEWHURST (P. C.). — British and American loco- tive design and practice. Some comparative com- nts thereon from practical experience. (21 400 words fig.)

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1922 625 .244 (.73)
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New designs of refrigerator cars for the Santa Fe. 000 words & fig.)

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ilway Age, No. 5, July 29, p. 199.
Strengthening Chicago track elevation Subways. (1 600 rds & fig.)

1922 625 .143. (01
ilway Age, No. 7, August 12, p. 277.
Determining the impact loads on track bolts. (1 000 ords, 1 table & fig.)

1922 656 .283 (.73)
ilway Age, No. 7, August 12, p. 287.
Missouri Pacific accident at Sulphur Springs, Mo. 000 words & fig.)

1922 621 .131 (.54)
ilway Age, No. 7, August 12, p. 299.
COLE (H. L.). — Standard designs for Indian loco- otives. (3 400 words, 1 table & fig.)

1922 621 .132.8 (.71)
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Gasoline switching locomotive with hydraulic drive. (2 000 words & fig.)

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Railway Age, No. 8, August 19, p. 333.
How the Illinois Central overcame a water shortage. (2 800 words & fig.)

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1922 621 .335 (.42)
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RAVEN (Sir Vincent L.). — High speed electric passenger locomotive, North Eastern Railway. (1 600 words & fig.)

1922 621 .132.6 (.42)
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New express passenger tank locomotives, Glasgow & South Western Railway (2 400 words & fig.)

1922 621 .135. (01
Railway Engineer, No. 511, August, p. 302.
Stability of locomotives at high speeds. (3 500 words & fig.)

1922 621 .33 (.42)
Railway Engineer, No. 511, August, p. 314.
Electrification of the London & North Western Railway suburban lines. (3 200 words & fig.)

Railway Gazette & News. (London.)

1922 625 .254
Railway Gazette & News, No. 4, July 28, p. 120.
Braking electric rolling-stock. (1 000 words & fig.)

1922 621 .132.3 (.54)
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Metre gauge passenger locomotives, Bombay, Baroda & Central India Railway. (700 words & fig.)

1922 621 .133.2
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Locomotive fireboxes. (1 000 words.)

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WILLIAMS (W. C.). — The advantages of articulated locomotives. (6 400 words & fig.)

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Indicating device for railway carriage doors. (1 000 words & fig.)

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Feed water heating and boiler circulating apparatus for locomotives. (2 200 words & fig.)

1922 625 .216 (.54) & 625 .251 (.54)
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« **Safety** in railway operation ». (900 words & fig.)

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Coal car of 120-tons capacity — Norfolk & Western Ry. (2 400 words & fig.)

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BURGESS (G. K.) & WOODWARD (R.W.).— Thermal stresses in **chilled iron car wheels.** (3 500 words & fig.)

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Powerful **mountain type passenger locomotive** for the Union Pacific Railroad. (1 200 words & fig.)

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LISTER (F. G.). — Effect of circulation on **locomotive boiler efficiency.** (3 200 words.)

1922 621 .132.5 (.73)
Railway and Locomotive Engin., No. 8, August, p. 199.
New and interesting **Mikado type locomotive** built at the Lima locomotive works for the Michigan Central. (1 800 words & fig.)

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Six-wheel truck for 120-ton capacity coal car for the Norfolk & Western Railway. (200 words & fig.)

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Completion of the London & North Western Railway Company's London **electrification scheme,** and inauguration of electric traction into Euston station. (3 500 words & fig.)

1922 621 .335 (.42)
Railway Magazine, No. 302, August, p. 92.
High speed main line passenger **electric locomotive,** North Eastern Railway. (700 words.)

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ALLEN (C. J.). — British **locomotive practice and performance.** (4 900 words, 3 tables & fig.)

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GRIME (E. M.). — Safeguarding **bridges** du floods. (1 200 words & fig.)

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FITHIAN (E. B.). — An interesting **turntable** re al. (900 words & fig.)

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ANDERSON (G. T.). — Improving the **line and** face of track. (2 200 words.)

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Railway Maintenance Engineer, No. 6, June, p. 213.
POWERS (J. W.). — **Piped rails and split head** (650 words & fig.)

1922 721 .9
Railway Maintenance Engineer, No. 7, July, p. 230.
How the Burlington builds **concrete culvert pipe.** words & fig.)

1922 625 .13
Railway Maintenance Engineer, No. 7, July, p. 242.
Bridge renewal involves use of piers 45 years (800 words & fig.)

1922 625 .143.
Railway Maintenance Engineer, No. 8, August, p. 27
Some interesting tests of **impact loads on track** (1 000 words, 1 table & fig.)

Railway Mechanical Engineer. (New York.

1922 621 .132.8
Railway Mechanical Engineer, No. 2, February, p. 7
Shay **geared locomotives** for mountain roads. words & fig.)

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Railway Mechanical Engineer, No. 2, February, p. 7
The development of the Robinson **connector.** words & fig.)

1922 621 .1
Railway Mechanical Engineer, No. 4, April, p. 187.
Walschaerts valve gear with variable lead. words & fig.)

1922 621 .1
Railway Mechanical Engineer, No. 4, April, p. 189.
Rolled steel **trailer wheels** for locomotives. (1 000 & fig.)

1922 621 .
Railway Mechanical Engineer, No. 4, April, p. 191
POWNALL (W.-A.). — Treated water improves **motive performance.** (2 600 words.)

1922 621 .133.3
Railway Mechanical Engineer, No. 4, April, p. 193.
FINCH (R. J.). — Calculating the efficiency of boiler seams. (2 300 words, 2 tables & fig.)

1922 625 .254 (.42)
Railway Mechanical Engineer, No. 4, April, p. 210.
Vacuum brake tests on English freight trains. (2 700 words & fig.)

1922 621 .7
Railway Mechanical Engineer, No. 4, April, p. 215.
CARACRISTI (V. Z.). — What shop equipment means to a railroad. (5 400 words, 2 tables & fig.)

1922 621 .133.3
Railway Mechanical Engineer, No. 4, April, p. 221.
WOODROFFE (G. H.) & LESTER (C. E.). — Installing and maintaining charcoal iron locomotive boiler tubes. (2 500 words & fig.)

1922 621. 134.1
Railway Mechanical Engineer, No. 5, May, p. 247.
Recent developments in the unaflow locomotive. (2 900 words & fig.)

1922 621 .133.7
Railway Mechanical Engineer, No. 5, May, p. 253.
Advantages of treating locomotive feed water. (3 000 words.)

1922 621 .133.2 (.73)
Railway Mechanical Engineer, No. 5, May, p. 255.
Service of Hulson grates on the Wabash. (800 words & fig.)

1922 621 .133.4
Railway Mechanical Engineer, No. 5, May, p. 257.
DA COSTA (H.). — Spark arresters for smokeboxes of wood-burning locomotives. (600 words & fig.)

1922 625 .232 (.42)
Railway Mechanical Engineer, No. 5, May, p. 261.
Some Pullman dining cars used in England. (1 300 words & fig.)

1922 625 .26 (.73)
Railway Mechanical Engineer, No. 5, May, p. 270.
Interesting car shop practices employed at Sayre. (1 600 words & fig.)

1922 621 .132.3 (.73)
Railway Mechanical Engineer, No. 7, July, p. 381.
A mountain type locomotive for high capacity. (2 400 words & fig.)

1922 625 .244 (.73)
Railway Mechanical Engineer, No. 7, July, p. 398.
WINTERROWD (W. H.). — Some notes on railway refrigerator cars. (6 000 words, 2 tables & fig.)

1922 621 .132.5 (.73)
Railway Mechanical Engineer, No. 8, August, p. 437.
A remarkable Mikado on the Michigan Central. (1 000 words & fig.)

1922 621 .133.8
Railway Mechanical Engineer, No. 8, August, p. 441.
Booster for tender trucks developed on D. & H. (1 200 words & fig.)

1922 621 .132.5 (.460)
Railway Mechanical Engineer, No. 8, August, p. 445.
Three-cylinder locomotive for spanish service. (1 700 words, tables & fig.)

1922 625 .244 (.73)
Railway Mechanical Engineer, No. 8, August, p. 455.
New designs of refrigerator cars for the Santa Fe. (2 000 words & fig.)

1922 621 .7 (.73)
Railway Mechanical Engineer, No. 8, August, p. 465.
High points at Reading locomotive shops. (3 200 words & fig.)

1922 621 .138.1 (.73)
Railway Mechanical Engineer, No. 8, August, p. 474.
New York Central engine terminal at Syracuse. (2 600 words & fig.)

Railway Review. (Chicago.)

1922 656. 211.4 (.73)
Railway Review, No. 4, July 22, p. 99.
Report on improvement of railroad terminals in St-Louis. (15 000 words & fig.)

1922 621 .132.5 (.73)
Railway Review, No. 4, July 22, p. 117.
Improved Mikado for the Michigan Central. (900 words & fig.)

1922 624 .63 (.73)
Railway Review, No. 5, July 29, p. 138.
Method of erection of concrete arches for New Philadelphia & Reading Railway. (400 words & fig.)

1922 625 .27 (.73)
Railway Review, No. 6, August 5, p. 161.
A Modern system of handling railroad stationary. (3 700 words & fig.)

1922 621 .132.8
Railway Review, No. 7, August 12, p. 201.
Turbo-condensing locomotive development in Europe. (3 400 words & fig.)

Railway Signal Engineer. (Chicago.)

1922 656 .253 (.42)
Railway Signal Engineer, No. 8, August, p. 307.
Train control approved by the British. (8 600 words.)

In Italian.

Giornale del genio civile. (Roma.)

1922 62. (01 & 669

Giornale del genio civile, 30 Giugno, p. 343.

BERTELLA (C. A.). — Sulle **prove di tensione dei metalli.** (3 400 parole, 10 tavole & fig.)

1922 621 .138.3

Giornale del genio civile, 30 Giugno, p. 401.

Centrali termiche per il **lavaggio e il riempimento delle caldaie delle locomotive.** (1 800 parole & fig.)

1922 624 .51 (.73)

Giornale del genio civile, 30 Giugno, p. 405.

Ponte sospeso sul fiume Delaware tra Filadelfia e Camden. (1 800 parole & fig.)

Rivista dei trasporti. (Milano.)

1922 621 .33 (01

Rivista dei trasporti, No. 7, Luglio, p. 79.

Ancora della convenienza economica della **trazione elettrica** sulle ferrovie secondarie e le tramvie. (5 400 parole & fig.)

1922 385 .113 (.45)

Rivista dei trasporti, No. 8, Agosto, p. 89.

Le **ferrovie dello Stato nel 1920-21.** (2 000 parole.)

1922 621 .332

Rivista dei trasporti, No. 8, Agosto, p. 91.

SORELLI (E.). — Sistema Ing. Sorelli per l'alimentazione delle linee a **trazione elettrica** a corrente continua. (4 000 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1922 621 .138.1

Rivista tecnica delle ferrovie, No. 1, 15 Luglio, p. 1.

IACOMETTO (I.). — Il **nuovo deposito locomotive** di Catania. (1 100 parole.)

1922 385 .517 (.42)

Rivista tecnica delle ferrovie, No. 1, 15 Luglio, p. 5.

BELMONTE (L.). — L'Istituto dei **Consigli di fabbrica** nelle Ferrovie brittanniche. (3 200 parole.)

1922 621 .32 (.45)

Rivista tecnica delle ferrovie, No. 1, 15 Luglio, p. 13

REGNONI (R.). — Gli impianti **elettrici** nella sede della Direzione Generale delle Ferrovie dello Stato. (2 300 parole & fig.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1922 621 .33 (.492)

Ingenieur, N^r 31, 5 Augustus, p. 605.

Beraadslaging over de voordracht « **Electrificatie** » onzer spoorwegen in het licht der tijdsomstandigheden ». (9 600 woorden.)

1922 351 .812.1 (.431)

Ingenieur, N^r 32, 12 Augustus, p. 623.

VAN DER MANDERE (H. Ch. G. J.). — Het nieuwe **spoorwegregime** in Opper-Silezië. (900 woorden.)

Monthly Bibliography of Railways [1]

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J. VERDEYEN,

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[016 .385. (02]

I. — BOOKS.

In French.

1922 625 .12 (02

DAUTRY, ingénieur en chef à la Compagnie du Nord; **GERVET**, ingénieur des ponts et chaussées, et **IMBERT**, ingénieur des chemins de fer de l'Etat.

Cours de chemins de fer. 1re partie : Etudes et travaux d'infrastructure.

Vannes, impr. Lafolye frères & Cie; Paris, Ecole spéciale des travaux publics, rue du Sommerard, rue Thénard et boulevard Saint-Germain. In-8°, 126 pages & fig.

1922 531. (02

LAMOTTE (Marcel).

Cours de mécanique appliquée.

Paris, Gauthier-Villars et Cie, 282 pages. (Prix : 25 francs.)

1922 351 .812.1 (04

MOUSSA (Mahmoud).

Etude sur le nouveau régime des chemins de fer.

Trévoux, impr. Jules Jeannin. In-8°, 164 pages.

1922 623. (02

Mouvements & transports. Organisation générale aux armées. I : Service de l'arrière aux armées.

Limoges, impr.-libr.-éditeurs Charles Lavauzelle & Cie, Paris, libr. de la même maison, 124, boulevard Saint-Germain. In-8°, 171 pages.

1922 624 .5 (02 & 624 .6 (02

RESAL (Jean), inspecteur général des ponts et chaussées.

Cours de ponts métalliques. Tome II. 3e fascicule : Ponts en arc, ponts suspendus.

Paris, 15, rue des Saints-Pères; Liége, 8, rue des Dominicains. 136 pages & 16 fig. (Prix : 12 francs.)

1922 385 .15 (.44)

SALVAGO (Georges).

Le problème de l'étatisation des chemins de fer en France depuis leur origine jusqu'en 1859.

Rennes, Impr. rennaise, 16, rue de Penhoët; Paris, libr. Edouard Duchemin, 18, rue Soufflot. In-8°, 311 p.

1922 693. (02

SIMONET (Eugène), conducteur des ponts et chaussées.

Maçonneries. (Nouveau tirage.)

Tours, impr. Deslis père, R. & P. Deslis; Paris (VIe), H. Dunod & E. Pinat, éditeurs, 47 et 49, quai des Grands-Augustins. XI-444 pages avec fig.

1922 347 .7

SOCIÉTÉ DES NATIONS.

La situation générale des transports en 1921. Exposés présentés par les Etats ayant participé à la 1re Conférence générale des communications et du transit, tenue en mars-avril 1921.

Bourg (Ain), impr. du *Courrier de l'Ain*. Genève. In-8°, 515 pages.

In German.

1922 692. (02

BRABBÉE (K.), ord. Professor an der Technischen Hochschule Berlin-Charlottenburg.

H. Rietschels Leitfaden der Heiz- und Lüftungstechnik.

Berlin, Verlag von Jul. Springer. Sechste, Auflage. Mit 299 Textabb. (zwei Bände). (Preis geb. für Deutschland : 330 Mark.)

1922 656 .2 (02

BUJAKOWSKY (E.), Eisenbahningenieur.

Einführung in den Eisenbahnbetriebsdienst.

Leipzig-Berlin, Verlag und Druck von B. G. Teubner. 140 Seiten. (Preis : 30 Mark.)

1922 62. (01 & 721 .9 (01

GRAF (Otto).

Widerstandsfähigkeit des Zugzone von Eisenbetonkörpern.

Berlin, Verlag von W. Ernst. 40 Seiten, 27 Abb. und 2 Tabellen. (Preis : 72 Mark.)

1922 721. (02

RISKE (Wilhelm), Architekt und Maurermeister.

Hochbau; Entwurf, Ausschreibung und Ausführung.

Breslau, Verlag Ostdeutsche Bauzeitung (Paul Steinke). (Preis brosch. : 30 Mark.)

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[1] The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See "Bibliographical Decimal Classification as applied to Railway Science," by L. Weissenbruch, in the number for November, 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1922 656 .215. (02
SARRE (Richard).
Handbuch der Ingenieurwissenschaften. 5. Teil, 5. Band :
Beleuchtung der Bahnhöfe und der Bahnhofshochbauten.
Leipzig, Wilhelm Engelmann. 300 Seiten und Abb. (Preis : 154 Mark.)

1922 385 .1
SAX (Emil) Dr.
Die Eisenbahnen. Dritter Band des Werkes des Verfassers : Die Verkehrsmittel in Volks- und Staatswirtschaft.
Berlin, Julius Springer. 8°. Zweite neubearbeitete Auflage. 614 Seiten. (Preis, geh. : 140 Mark.)

1922 624. (02
SCHAU (A.).
Der Brückenbau. 2. Teil : Die eisernen Brücken.
Leipzig, Berlin, Verlag und Druck von B. G. Teubner. 2. Auflage mit 464 Abb. in Text und auf 8 Tafeln. (Preis : 45 Mark.)

1922 624 .2 (02
SOLL (G.), Studienrat an der Städtischen Baugewerkschule in Barmen-Elberfeld.
Einfache Berechnung des durchlaufenden Trägers für unbewegliche Lasten.
Berlin, Verlag von Wilh.Ernst & Sohn. Mit 42 Textabb. (Preis, geh. : 117 Mark.)

1922 721 .9
SPITHALER (C.) & GARY (M.).
Festigkeit von Beton bei wechselndem Sandgehalt der Zuschlagstoffe in erdfeuchten, weichen und flüssigen Beton.
Berlin, Verlag von Wilhelm Ernst & Sohn. (Preis, geh. : 315 Mark.)

In English.

1922 621 .134.5
AHRONS (E. L.).
Lubricating of locomotives.
London, Locomotive Publishing Co. 8vo (8 1/4×5 3/4 inches), 192 pages. (Price : 5 s. net.)

1922 385. (06.14 & 656 .254 (.73)
American Railway Association Proceedings. Telegraph and Telephone section, March, 1922.
New York, 30, Vesey Street. (9 1/4×6×7/8 inches), 521 pages.

1922 625 .212. (01
BURGESS (G. K.) & WOODWARD (R. W.).
Thermal stresses in chilled iron car wheels.
Washington, Government Printing Office. (10×7 inches), 34 pages and diagrams. (Price : 5 cents.)

1922 721 .9 (02
DANA (Richard T.), M. Am. Soc. C. E., & KINGSLEY (James).
Concrete computation charts.
New York, Codex Book Company, Inc. (11 1/2×8 3/4 inches), 14 pages. (Price : $5.00.)

1922 621 .3 (02
DAVIDGE (H. T.), M. I. E. E. & HUTCHINSON (Robert W.), M. Sc. A. M. I. E. E.
Technical electricity.
London, University Tutorial Press. 4th edition. (Price: 10 s. 6 d. net.)

1922 692. (02
EVANS (Edwin J.).
Building contracts.
New York, E. P. Dutton & Co. (9×6 inches), 304 pages. (Price : $5.00.)

1922 621 .3 (03
GLAZEBROOK (Sir Richard).
A dictionary of applied physics. (In 5 vols.) Vol. 2. Electricity.
London, Macmillan. 8vo (9 1/4×6 inches), 1 111 pages. (Price : 63 s. net.)

1922 669 .1
HALL (John Howe).
Steel foundry.
New York & London, McGraw-Hill Book Co., Inc. 2nd edition. (9×6 inches), 334 pages, illust. (Price : $4.00.)

1921 69 (02
KETCHUM (Milo S.), M. Am. Soc. C. E.
The design of steel mill buildings and the calculation of stresses in framed structures.
New York & London, McGraw-Hill Book Co., Inc. 4th edition. (9×6 inches), 632 pages and diagrams. (Price : $6.00.)

1922 625 .1 (02
Maintenance of way cyclopedia.
New York, Woolworth Building. London, S. W. 1. 34, Victoria Street, Simmons-Boardman Publishing Co., Book service Department. (9×12 inches), 860 pages, 2 500 illust. (Price : $10.00.)

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MARSH (Ch. F.), M. Inst. C. E., & Dunn (W.), Assoc. Inst. C. E.
Manual of reinforced concrete.
London. Constable & Co., Ltd. (Price : 21 s. net.)

1922 691. (02
MOORE (Herbert F.).
Text-book of the materials of engineering.
New York, McGraw-Hill Book Co., Inc. 3rd edition. (9×6 inches), 325 pages, illust. (Price : $3.00.)

1921 669 .1
NEWTON FRIEND (J.).
Iron and its compounds.
London, Charles Griffin & Co., Ltd. (9×6 inches), 265 pages. (Price : 18 s.)

1922 669 .1
PULSIFER (H. B.).
Determination of sulfur in iron and steel.
Easton, Pa., Chemical Publishing Co. (9×6 inches), 160 pages, illust. (Price : $2.50.)

1922 691. (02
LVER (H. E.).
Materials of construction.
New York, McGraw-Hill Co., Inc. (9×6 inches), pages, illust. (Price : $3.00.)

1921 693. (02
AULDING (Frederick P.).
Masonry structures.
New York, Wiley & Sons, Inc. (9×6 inches), 404 ges. (Price : $3.50.)

1922 313 .385 (.73)
Statistics of railways in the United States for the ar ended December 31, 1918. Thirty-second annual ort.
Washington : Government Printing Office. (9 1/2 × 1 1/4 inches), 807 pages.

922 656 .256. (09.3 (.73)
he invention of the track circuit.
New York, Published by the Signal section of the erican Railway Association, H. S. Balliet, Secretary, Vesey Street. (Price : $1.50.)

922 385. (02
e Universal Directory of railway officials 1922.
ondon, S. W. 1., The Directory Publishing Company, ited, 33, Tothill Street. (5 1/2×8 1/2×1 1/2 inches). ice : 20 s. net.)

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HENRICI (Major E. O.). — Precise levelling. (23 0 words, 5 tables & fig.)

1922 721 .1 (
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CROSTHWAITE (P. M.). — Experiments on the hor zontal pressure of sand. (9 000 words, 6 tables & fig

922 721 .2
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JLTON (A. R.). — Overturning moment on **retaining walls.** (19 000 words, 6 tables & fig.)

922 62. (01 & 691
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ORNE (A. R.). — Strength and other properties of **s pine.** (4 700 words, 5 tables & fig.)

922 699
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BELL (Th. B.). — Reinforced concrete for **shipstruction.** (9 500 words, 5 tables & fig.)

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922 621 .33 (.82)
lway Age, No. 9, August 26, p. 375.
ILEY (L. G.). — Steam road **electrification** in the entine. (1 800 words & fig.)

922 625 .154
lway Age, No. 9, August 26, p. 383.
win span **turntable** reduces load on center. (1 500 ds & fig.)

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ASFORD (G. M.). — Locomotive **fuel,** the life blood ransportation. (5 400 words & fig.)

922 621 .132.5 (.73)
lway Age, No. 10, September 2, p. 411.
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922 656 .212.6 (.71)
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EWELL (F.). — Canadian national installs **grain unloaders.** (3 800 words & fig.) &

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UGINA (A. R.). — **Train orders** by signal indicaıs. (1 500 words & fig.)

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olorado prepares new plans for Moffat tunnel. (1 400 ds & fig.)

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ERSCHEL KOYL (C.). — St. Paul adopts water atment on large scale. (2 600 words & fig.)

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The Cowlairs **works** of the North British Railway. (2 000 words & fig.)

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British standard specification and sections for **bull-head railway rails.** (1 600 words.)

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Long distance operation of **facing points** Metropolitan and Great Central Joint Line. (2 000 words & fig.)

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Railway Engineer, No. 512, September, p. 343.
Insulating rail joints for **track-circuit.** (700 words & fig.)

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1922 621 .132.6 (.54)
Railway Gazette & News, No. 9, September 1, p. 279.
Heavy 2-10-2 type **tank locomotives** for the Bombay Port Trust. (650 words & fig.)

1922 656 .225 (.42)
Railway Gazette & News, No. 9, September 1, p. 281.
The **freight train services** of the Great Western Railway. (2 900 words, tables & fig.)

1922 656 .212.6 (.42)
Railway Gazette & News, No. 9, September 1, p. 288.
Rail loading machine in use on the Great Northern Railway. (500 words & fig.)

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Long distance operation of **facing points.** Metropolitan and Great Central Joint Railway. (1 500 words & fig.)

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1922 621 .132.3 (.42)
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Rebuilt **express locomotives-** London, Brighton & South Coast Railway. (1 300 words & fig.)

1922 624. (01 (.42)
Railway Gazette & News, No. 11, September 15, p. 341.
The strength of **railway bridges.** (1 900 words, 1 table & fig.)

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The value of a **larger load gauge.** (900 words & fig.)

1922 656 .254 (.54)
Railway Gazette & News, No. 12, September 22, p. 363.
The **train control system** of the Great Indian Peninsula Railway. (2 200 words & fig.)

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Railway Gazette & News, No. 12, September 22, p. 367.
America's most efficient **locomotive.** (1 300 words & fig.)

1922 621 .131.3 (.42)
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Test of the new « **Pacific** » **locomotive,** No. 1471, on the Great Northern Railway. (1 200 words & fig.)

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European **express train services.** (1 800 words & tables.)

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The Michigan Central's **Mikado** (2-8-2) **type locomotive** No. 8 000. (2 000 words & fig.)

1922 625 .234
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A **thermostatic control of car heating.** (2 300 words & fig.)

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BAXTER (W. M.). — Mechanical **refrigeration of railroad cars.** (4 400 words & fig.)

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Railway Magazine, No. 303, September, p. 181.
— — No. 304, October, p. 263.
ALLEN (C. J.). — **British locomotive practice** and performance. (10 200 words, tables & fig.)

Railway Maintenance Engineer. (Chicago.)

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Power tools expedite **maintenance work** on railroads overseas. (1 300 words & fig.)

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Railway Maintenance Engineer, No. 9, Sept., p. 311.
Chicago **track elevation structures** being strengthened. (1 800 words & fig.)

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1922 621 .132.5 (.73)
Railway Mechanical Engineer, No. 9, Sept., p. 497.
New Michigan Central **Mikado** has many special features. (2 200 words, 1 table & fig.)

1922 621 .132.8 (.71)
Railway Mechanical Engineer, No. 9, Sept., p. 503.
Gasoline switching locomotive with hydraulic drive. (2 000 words & fig.)

1922 625 .232 (
Railway Mechanical Engineer, No. 9, Sept., p. 511.
Santa Fé acquires eight **all steel dining cars.** (1
words & fig.)

1922 625 .242 (
Railway Mechanical Engineer, No. 9, Sept., p. 517.
70-ton D. & R. G. W. General service **Gondola** (1 500 words, 1 table & fig.)

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HARTOUGH (E. W.). — Periodical repacking **journal boxes.** (1 800 words & fig.)

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1922 621 .134.1 (
Railway Review, No. 8, August 19, p. 231.
How **locomotive rods** are tested and machined Lima. (1 900 words & fig.)

1922 625 .24
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WILLIAMS (H. W.). — Some factors to be co dered in **freight car design.** (2 100 words & fig.)

1922 621 .33 (.4
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Electrification improves alpine scenery on Rhae Ry. (2 500 words & fig.)

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Some important innovations in new Lima **Mik locomotive.** (2 000 words & fig.)

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WOODROFFE (G. H.) & LESTER (C. E.). — Ap cation and maintenance of **locomotive boiler tubes.**(5 words & fig.)

1922 621 .1
Railway Review, No. 11, September 9, p. 333.
The **una-flow locomotive.** A practical possibil (4 000 words & fig.)

1922 385. (09.1 (.
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SMITH (H. K.). — The **Japanese railways** and t operating problems. (3 700 words & fig.)

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The Union system of automatic **train control.** (4 words & fig.)

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1922 656 .256 (.4
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LASCELLES (T. S.). — **Controlled manual block** Hauenstein tunnel. (2 600 words & fig.)

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OUGH (S. J.). — The application of caustic soda to railway signaling. (4 000 words & fig.)

)22 656 .253
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ACOBS (H. M.). — Overload protection of A. C. al power lines. (2 300 words & fig.)

)22 656 .253
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AMES (C. H.). — Care and lining of signal lamps. 00 words & fig.)

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OHNSON (R. C.). — Locating automatic block als for heavy traffic. (3 600 words & fig.)

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C. C. statistics and tables on signaling. (1 200 words, ible & fig.)

Transport & Travel Monthly (London.)

922 656 .224
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icket frauds : how railways prevent and detect n. (5 400 words.)

University of Illinois Bulletin. (Urbana.)

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versity of Illinois Bulletin, No. 41, June 5, p. 9.
ICHARDS (C. R.) & VEDDER (J. N.). — The re- ting of compressed air. (14 000 words, 11 tables ig.)

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Giornale del genio civile. (Roma.)

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IASTRODICASA (S.). — Applicazione delle linee statiche allo studio dei fabbricati lesionati per cedi- nto delle fondazioni. (9 500 parole & fig.)

1922 62. (01
Giornale del genio civile, 31 luglio, p. 450.
FIGARI (F.). — Sul cimento a tensione dei solidi prismatici. (3 000 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma.)

1922 624 .9 & 695
Rivista tecnica delle ferrovie, No. 2, 15 agosto, p. 29.
PARTANNI (S.). — Sostituzione della grande teltoia del fabbricato viaggiatori di Milano centrale con pensiline provvisorie. (6 200 parole & fig.)

1922 625 .143.2 & 625 .143.4
Rivista tecnica delle ferrovie, No. 2, 15 agosto, p. 47.
MEUCCI (G.). — Sulla qualità del metallo delle ganasce dell'armamento ferroviario. (4 200 parole, 2 quadros & fig.)

In Spanish.

Gaceta de los Caminos de hierro. (Madrid.)

1922 385. (09.3 (.82)
Gaceta de los Cam. hierro, No. 3343, 1 de sept., p. 289.
SALAZAR (J.). — Inauguración del primer ferrocarril argentino. (2 000 palabras & fig.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1922 531
Ingenieur, N^r 33, 19 Augustus, p. 641.
HAARMAN (J. H. A.). — De knik van een staaf, aan de einden en in het midden elastisch gesteund zoowel wat een uitwijking uit den oorspronkelijken stand, als wat draaiing betreft. (1 200 woorden & fig.)

1922 531
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BARGEBOER (A.). — Het uitbalanceeren van snel roteerende machinedeelen. (800 woorden.)

1922 621 .31 (.92)
Ingenieur, N^r 35, 2 September, p. 670.
JANSSEN VAN RAAY (F. A.). — Eenige mededeelingen over den bouw van grootere waterkrachtwerken door den dienst voor waterkracht en electriciteit in Nederlandsch-Indie. (6 400 woorden & fig.)

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ADAMS (H. F.). — Schakeltrein of trekwagen. (2 200 woorden.)

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[016 .385. (02]

I. — BOOKS.

In French.

1922 697. (02

ENY (Ed.), ingénieur des arts et métiers.

Chauffage et ventilation.

Vannes, impr. Lafolye frères et Cie.

Paris, G. Loubat (S. M.). 2e édition. In-8°. 156 pages fig.

1922 621 .9 (02

ACQUET (A.), professeur de l'enseignement technique.

Les machines-outils servant au travail des métaux.

Paris (VIe), Dunod, éditeur, 47 et 49, quai des Grands-Augustins (13×21), IV-160 pages avec 173 fig. (Prix : 30 francs.)

In German.

1922 531. (02

UTENRIETH (Ed.).

Technische Mechanik. Ein Lehrbuch der Statik und Dynamik für Ingenieure.

Berlin, Verlag von Julius Springer. Dritte, verbesserte Auflage. (Preis, geb. : 23.40 frank.)

1922 625 .2 (02

EHNKE (F.), Eisenbahn-Oberingenieur.

Bücherei des Verbandes deutscher Eisenbahnfachschulen. E. V. Band 5 : Eisenbahnwagenbau.

Berlin, B. G. Teubner. (Preis : 17.50 Mark.)

1922 624 .2 (01 & 721 .1 (01

ÖRR (Heinrich), Dr.-Ing.

Die Tragfähigkeit der Pfähle.

Berlin, Verlag von Wilhelm Ernst & Sohn. (Preis, geh. : 20 Mark.)

1922 385 .587. (02

ANTT (H. L.).

Organisation der Arbeit.

Berlin, Verlag von Julius Springer. (Preis : 4.30 Mark.)

1921 721. (02

Handbibliothek für Bauingenieure. Ein Hand- und Nachschlagebuch für Studium und Praxis. II. Teil : **Eisenbahnwesen und Städtebau. 6. Band : Eisenbahn-Hochbauten.** Von CORNELIUS (C.), Regierungs- u. Baurat in Berlin.

Berlin, Verlag von Julius Springer. VIII-128 Seiten mit 157 Textabb. (Preis : 384 Mark.)

1922 656 .25 (02

Handbibliothek für Bauingenieure Ein Hand- und Nachschlagebuch für Studium und Praxis. **II. Teil : Eisenbahnwesen und Städtebau. 7. Band : Sicherungsanlagen im Eisenbahnbetriebe** auf Grund gemeinsamer Vorarbeit mit Dr. Ing. M. ODER. verfast von Dr. Ing. W. CAUER, Mit einem Anhang : Fernmeldeanlagen und Schranken von Dr. Ing. F. GERSTENBERG.

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1922 69 (02

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Die Statik der Bauwerke.

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MÜLLER (A.), Lehrer an der Eisenbahnfachschule in Magdeburg.

Bücherei des Verbandes deutscher Eisenbahnfachschulen. E. V. Band 6. Erdkunde. I. Teil : Deutschland und sein Verkehrsnetz.

Berlin, B. G. Teubner. (Preis : 18.75 Mark.)

1921 669 .1 (02

PREUSS (E.), Dr.-Ing.

Die praktische Nutzanwendung der Prüfung des Eisens durch Ätzverfahren und mit Hilfe des Mikroskops.

Berlin, Julius Springer. (Preis : 18.40 Mark.)

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Mechanik. Aus « Handbibliothek für Bauingenieure »; Hanover. Mit 237 Textfiguren. (Preis, geb. : 6 Frank.)

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In English.

1922 62. (01 (06 (.73)

American Society for testing materials year book, August 1922.

Philadelphia, Headquarters of the Society, 1315, Spruce Street. (9×6×1/2 inches), 293 pages.

1922 621 .133.1 (02

BOOTH (Wm. H.), F. G. S.

Liquid fuel and its apparatus.

New York, E. P. Dutton & Company. Second edition. 8vo, 308 pages illustrated. (Price : $4.00 net.)

1922-23 625 .2 (03 (.73)

Car builders' cyclopedia of American practice.

New York, Simmons-Boardman Publishing Company; London, 34, Victoria Street. (12×9 inches), illustrations. (Price : $8.)

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FOWLER (Frank F.), editor-in-chief.

Standard handbook for electrical engineers.

New York and London, McGraw-Hill Book Co. Fifth edition. (7×4 inches), 2 137 pages, diagrams. (Price: $6.)

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HEWITT (B. H. M.).

Shield and compressed air tunneling.

New York and London, McGraw Hill Book Co. (6×9 inches), 465 pages. (Price : $5.00.)

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Topeka, Kan., Published by the Association. S. Cooper, secretary, c/o Atchison, Topeka & Santa (6×9 inches), 534 pages, illust. (Price : $5.00.)

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Returns of the capital, traffic, receipts and worki expenditure, etc., of the railway companies of the Unit Kingdom for the year 1921. London, His Majesty's St tionery Office, 280 pages. (Price : 21 s.)

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The railway signal and permanent way enginee pocket book.

London, Locomotive publishing Co. 2nd edition, 18 (5 1/2×3 1/4 inches), 326 pages. (Price : 5 s.)

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Structural problems, part I.

Toronto, Engineering Society of the University Toronto. 2nd edition. (6×9 inches), 96 pages.

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1922 721 .9 (

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Costruzioni in cemento armato.

Milano, U. Hoepli. Terza edizione aumentata. xv 325 pagine. (Prezzo : 11.50 Lire.)

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II. — PERIODICALS

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1922 62. (01

Ann. des ponts et chauss., part. techn., juillet-août, p. 5.

FERET (R.). — Essais prolongés de résistance et de décomposition des principaux types de liants hydrauliques. (10 000 mots & 8 tableaux.)

1922 725 .34 (.44)

Ann. des ponts et chauss., part. techn., juillet-août, p. 34.

LECOCQ. — Installations créées au cours de la guerre pour intensifier le rendement du port de Cherbourg. (4 800 mots & fig.)

1922 625 .113

Ann. des ponts et chauss., part. techn., juillet-août, p. 77.

VALLETTE (R.). — Détermination mécanique du centre d'ordonnée moyenne d'une courbe. (200 mots & fig.)

Annales des travaux publics de Belgique. (Bruxelles.)

1922 624 .1 (.43

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Destruction par l'action d'eau minérale corrosiv d'une pile de pont, fondée sur caisson à air comprim à Magdebourg. (2 300 mots & fig.)

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1922 721 .9 (0

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CHAUDY (F.). — Les ceintures des pièces comprimée en béton armé. (2 600 mots & fig.)

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1922 621 .31 (.494

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CHENAUD (H.) & DU BOIS (L.). — Usine hydro électrique de Fully. (3 800 mots & fig.)

1922 625 .13 (01
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MAILLART (R.). — De la construction de galeries is pression intérieure. (4 000 mots & fig.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1922 313 .385 (.3)
Ill. des transp. intern. par ch. de fer, octobre, p. 177.
Les chemins de fer du monde en 1920. (1 000 mots & ableau.)

Génie civil. (Paris.)

1922 621 .9
nie civil, n° 2095, 7 octobre, p. 330.
Pelles pneumatiques pour la construction de tunnels ns les terrains argileux. (500 mots & fig.)

1922 621 .331 (.73)
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La station centrale thermo-électrique de la Milwaukee ectric Railway and Light Company, chauffée au char- n pulvérisé. (3 200 mots & fig.)

1922 721 .1 (.73)
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La construction des fondations d'un bâtiment à New rk, en même temps que l'édification des murs, par procédé Pretest. (600 mots & fig.)

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RENÉ (G.). — La politique des chemins de fer en ne. Ce qu'elle est, et ce qu'elle doit être. (2 500 mots.)

922 62. (01
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OGOFF (A.). — Calcul de l'arc à deux articulations ibre moyenne parabolique. (1 800 mots & fig.)

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es voitures à couchettes de 2e et 3e classes des che- ns de fer de l'Etat. (600 mots & fig.)

922 621 .132.8 (.44)
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ALFAS (P.). — Les nouvelles automotrices à moteur xplosion des chemins de fer de l'Etat. (2 300 mots ig.)

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Génie civil, n° 2098, 28 octobre, p. 399.
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1922 656 .253
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LEBROT (V.). — Un nouvel appareil de sécurité pour les chemins de fer. (3 200 mots & fig.)

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A propos de l'éclairage des voitures de chemin de fer. (1 200 mots.)

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Les locotracteurs Schneider. (1 000 mots & fig.)

1922 625 .211. (01
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CHAMON (L.). — Note sur le calcul des longerons armés pour voitures et wagons. (1 800 mots & fig.)

1922 385 .15 (.43)
Revue générale des ch. de fer, n° 4, octobre, p. 235.
Le projet de réorganisation des chemins de fer allemands. (6 300 mots.)

1922 621 .132.1 (.42+.73)
Revue générale des ch. de fer, n° 4, octobre, p. 247.
Comparaison des locomotives anglaises et américaines. (13 000 mots & 1 tableau.)

1922 656 .23 (.43)
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La question des relèvements de tarifs en Allemagne. (1 000 mots & 3 tableaux.)

1922 621 .138.3 (.45)
Revue générale des ch. de fer, n° 4, octobre, p. 279.
Installation des chemins de fer italiens pour utiliser la chaleur de l'eau de vidange des chaudières de locomotives. (2 800 mots & fig.)

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DOWSON (R.) & ROSEN (J.). — Progrès réalisés dans la construction des turboalternateurs de grande puissance en Grande-Bretagne. (4 200 mots, 6 tableaux & fig.)

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1922 656 .254

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CORNET (C.). — Le **téléphone automatique.** (10 000 mots & fig.)

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Sur l'électrification des chemins de fer au moyen de **courants alternatifs de fréquence élevée.** (1 500 mots & fig.)

In German.

Glasers Annalen. (Berlin.)

1922 621 .133.3 & 621 .133.7

Glasers Annalen, Heft 6, 15. September, S. 86.

ZIEMERT. — **Kesselstein,** sein Entstehen und Massnahmen zur Verhütung und Beseitigung in Dampferzeugern, insbesondere Dampflokomotiven, und in Kühlelementen. (5 000 Wörter, 3 Tabellen & Abb.)

Organ für die Fortschritte des Eisenbahnwesens (Berlin und Wiesbaden.)

1922 625 .142.4 & 721 .9

Org. für die Fortschr. des Eis., Heft 15, 1. August, S. 217.

ROUDOLF.— **Querschwelle aus Eisenbeton** für Hauptbahnen mit Regelspur. (500 Wörter & Abb.)

1922 656 .259

Org. für die Fortschr. des Eis., Heft 15, 1. August, S. 220.

Selbsttätige **Zugsteuerung** von Sprague. (2 300 Wörter & Abb.)

1922 624. (01

Org. für die Fortschr. des Eis., Heft 16, 15. Aug., S. 233.

SCHAECHTERLE (K.). — Verstärkung von **eisernen Bahnbrücken** für den Verkehr Schwerer Lokomotiven. (5 300 Wörter, 2 Tabellen & Abb.)

1922 621 .133.2

Org. für die Fortschr. des Eis., Heft 16, 15. Aug., S. 240.

BARKHAUSEN (G.). — Bewegliche **Stehbolzen** für **Lokomotivkessel.** (900 Wörter & Abb.)

Schweizerische Bauzeitung. (Zürich.)

1922 624. (01 (.494)

Schweizerische Bauzeitung, Nr. 15, 7. Oktober, S. 168.

ROS (M.). — **Nebenspannungen** infolge vernieteter Knotenpunkt-Verbindungen **eiserner Fachwerk-Brücken.** (2 500 Wörter & Abb.)

1922 621 .87 (.494)

Schweizerische Bauzeitung, Nr. 15, 7. Oktober, S. 171.

Laufkrane von 80-t Tragkraft in der Lokomotiv-Reparaturwerkstätte der S. B. B. in Bellinzona. (400 Wörter & Abb.)

1922 621 .337 (.494)

Schweizerische Bauzeitung, Nr. 16, 14. Oktober, S. 175.

SCHULER (H. W.). — **Schaltanordnungen in den Fahrleitungs-Anlagen** der Schweizerischen Bundesbahnen. (2 800 Wörter & Abb.)

1922 62

Schweizerische Bauzeitung, Nr. 18, 28. Oktober, S.

RIKLI (H.). — Neuere Entwicklung im Bau **Turbo-Generatoren.** (4 000 Wörter & Abb.)

1922 62.

Schweizerische Bauzeitung, Nr. 18, 28. Oktober, S. 20

EGGENSCHWILJER (Ad.). — Ueber Drehung Biegung von [- Eisen. (1 600 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungswesen. (Berlin.)

1922 656 .256 (.

Zeitschr. f. das ges. Eis., Nr. 19, 10. Oktober, S. 97.

ODENBACH. — Beeinflussung von bahneige **Schwachstromleitungen** durch fremde Starkstromleit gen. (3 400 Wörter, 2 Tafeln & Abb.)

Zeitung des Vereins deutscher Eisenbahnverwaltungen. (Berlin.)

1922 656 .

Zeitung des Vereins, Nr. 37, 5. Oktober, S. 733.

NOUVORTNE. — Die Bedeutung der Verkehrsk trolle II für die Einnahmen aus dem **Güterverk** (1 800 Wörter.)

1922 343 .346 (.

Zeitung des Vereins, Nr. 38, 12. Oktober, S. 749.

SEYBOLD. — Die Bahnpolizei und das **Eisenba strafrecht** im Neuen Strafgesetzbuchentwurf von 1 (2 800 Wörter.)

Zeitschrift des Vereines deutscher Ingenieure (Berlin.)

1922 62

Zeit. des Vereines deutsch. Ingen., Nr. 40, 7. Okt., S.

Eine neuartige **Klappbrücke.** (200 Wörter & Abb.)

1922 621

Zeit. des Vereines deutsch. Ingen., Nr. 41, 14. Okt., S.

KESSNER. — Normale Dampfdrehkrane. (1 800 W ter, 1 Tafel & Abb.)

In English.

American Machinist. (London.)

1922 62

American Machinist, No. 9, October 21, p. 334.

Heavy machine work in a **railroad shop.** (1 800 w & fig.)

Engineer. (London.)

1922 385 .15 (.42+.

Engineer, No. 3484, October 6, p. 361.

Railway management. (2 400 words.)

1922 313 .385 (.42) & 385 .113 (

Engineer, No. 3485, October 13, p. 392.

The railway **returns** for 1921. (2 400 words.)

1922 624 .63 (.54)
ngineer, No. 3486, October 20, p. 411.
Reinforced concrete bridge over the River Pambayaur t Chengannur. (1 000 words & fig.)

1922 625 .13 (.42)
ngineer, No. 3487, October 27, p. 450.
Strengthening New Holland railway pier. (500 words fig.)

Engineering. (London.)

1922 385. (09.1 (.6)
ngineering, No. 2963, October 13, p. 451.
The railways of East Africa. (2 200 words.)

1922 621 .134.1
ngineering, No. 2963, October 13, p. 464.
Locomotive connecting-rod failures. (1 000 words.)

1922 62. (01 & 624 .2
ngineering, No. 2964, October 20, p. 484.
Floor slab, beam and column testing machine at the National Physical Laboratory. (3 800 words & fig.)

1922 625 .216
ngineering, No. 2964, October 20, p. 490.
High-capacity railway screw couplings. (800 words & fig.)

1922 621 .138.2 (.42)
ngineering, No. 2965, October 27, p. 511.
Locomotive coal and ash-handling plant at Crewe. (3 000 words & fig.)

Engineering News-Record. (New York.)

1922 625 .111
ngineering News-Record, No. 13, September 28, p. 515.
CONARD (C. K.). — Reverse studies detect errors in railroad location. (1 100 words.)

1922 721 .1 & 721 .9
ngineering News-Record, No. 13, Sept. 28, p. 526.
Placing concrete by several methods on same Job. (800 words & fig.)

1922 385 .587. (01 & 69 (01
ngineering News-Record, No. 14, October 5, p. 548.
HILL (C. S.). — Lost time in construction. The causes of lost time. (3 600 words.)

1922 625 .111
ngineering News-Record, No. 14, October 5, p. 552.
FISKE (H. C.). — Air photos as plane-table sheets aid mapping. (2 500 words & fig.)

1922 621 .133.7 (.73)
ngineering News-Record, No. 14, October 5, p. 560.
HERSCHEL KOYL (C.). — Extensive boiler-water treating on C., M. & St. P. Ry. (2 400 words & fig.)

1922 624 .63 (.73)
ngineering News-Record, No. 14, October 5, p. 563.
SCALES (G. F.). — Building a five-span concrete bridge in cold weather. (500 words, 1 table & fig.)

1922 691
Engineering News-Record, No. 14, October 5, p. 567.
Steel powder as a concrete content. (200 words.)

1922 62. (01
Engineering News-Record, No. 14, October 5, p. 568.
WINSLOW (A. M.). — Bending moments in pins or shafts determined graphically. (1 000 words & fig.)

1922 656 .212.6 (.73)
Engineering News-Record, No. 15, October 12, p. 604.
TRABER (Ch. K.). — Aerial tramways serve mixing plant at Gilboa Dam. (2 000 words & fig.)

1922 721 .1 (.73)
Engineering News-Record, No. 15, October 12, p. 606.
Foundation tests for Nebraska State Capitol. (1 800 words & fig.)

1922 625 .13 (.73)
Engineering News-Record, No. 15, October 12, p. 621.
Strengthening truss bridge over tracks at Chicago. (1 000 words & fig.)

1922 725 .31 (.73)
Engineering News-Record, No. 15, October 12, p. 623.
Transfer of whole town 11 miles by truck and trailer. (900 words & fig.)

1922 721 .9 (.73)
Engineering News-Record, No. 16, October 19, p. 640.
Ohio Stadium, a double-deck steel and concrete horse-shoe. (3 200 words & fig.)

1922 624 .63 (.73)
Engineering News-Record, No. 16, October 19, p. 655.
Boldly designed center for heavy concrete arch. (1 300 words & fig.)

1922 725 .35 (.73)
Engineering News-Record, No. 16, October 19, p. 657.
Railway car-icing plant to serve refrigerator trains. (500 words & fig.)

Great Western Railway Magazine. (London.)

1922 725 .33 (.42)
Great Western Ry. Magazine, No. 10, October, p. 466.
Reinforced concrete locomotive filling tanks. (500 words & fig.)

Locomotive, Railway, Carriage and Wagon Review. (London.)

1922 621 .132.1 (.92)
Loc. Ry. Carr. & Wagon Review, October 14, p. 299.
LASSUEUR (E.). — Recent locomotives for the Dutch Indies Railways. (1 200 words & fig.)

Proceedings, American Railway Association. (New York.)

1922 656 .256
Proceed., Amer. Ry. Ass^{on}, session June 14/16, p. A341.
JOHNSON (R. C.). — A scientific method of locating automatic block signals for a railroad of heavy traffic. (7 300 words & fig.)

Proceedings, American Society of civil engineers. (New York.)

1922 721 .9 (01

Proc. Amer. Soc. civil eng., No. 8, October, p. 1653.

LUNDAHL (R. R.). — **Bond strength of wood piles in concrete.** (4 000 words, 2 tables & fig.)

1922 721 .9

Proc. Amer. Soc. civil eng., No. 8, October, p. 1665.

MACQUEEN (P. O.). — The comparison of **concrete groined arches** as an aid in their design. (2 800 words, 4 tables & fig.)

1922 624. (01

Proc. Amer. Soc. civil eng., No. 8, October, p. 1675.

Locomotive **loadings for railway bridges.** (12 000 words, tables & fig.)

1922 624. (01

Proc. Amer. Soc. civil eng., No. 8, October, p. 1717.

Tentative specifications for **steel railway bridges.** (5 300 words & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1922 621 .133.7

Proceed., Instit. of Mechan. Eng., No. 4, June, p. 715.

SAUVAGE (E.). — **Feed-water heaters** for locomotives. (2 200 words & fig.)

1922 621 .335

Proceed., Instit. of Mechan. Eng., No. 4, June, p. 735.

RAVEN (V. L.). — **Electric locomotives.** (9 600 words, 4 tables & fig.)

1922 669

Proceed., Instit. of Mechan. Eng., No. 4, June, p. 885.

LEA (F. C.). — The effect of temperature on some of the **properties of metals.** (2 800 words, 5 tables & fig.)

Railway Age. (New York.)

1922 725 .31

Railway Age, No. 14, September 30, p. 599.

Work under way on **Union station headhouse.** (2 500 words & fig.)

1922 625 .162 (.73)

Railway Age, No. 15, October 7, p. 641.

PEABODY (J. A.). — **Highway crossing** protection, theory and practice. (3 800 words & fig.)

1922 625 .246

Railway Age, No. 15, October 7, p. 645.

PILCHER (J. A.). — The design of **steel freight car** equipment. (5 500 words.)

1922 625 .172 (.73)

Railway Age, No. 15, October 7, p. 655.

Cleaning track with a power driven sweeper. (800 words & fig.)

1922 621 .131.3 (.73)

Railway Age, No. 16, October 14, p. 687.

Service records of U. P. mountain type locomotives. (1 400 words & fig.)

1922 385 .524 (.73

Railway Age, No. 16, October 14, p. 691.

Employee representation on the Pennsylvania. (7 8 words & fig.)

1922 624 .6

Railway Age, No. 16, October 14, p. 705.

HIRSCHTHAL (M.). — Development of **concrete** railway construction. (3 500 words & fig.)

1922 621 .132

Railway Age, No. 16, October 14, p. 711.

Steam-propelled Unit Railway **motor car.** (2 400 word & fig.)

1922 621 .33 (.73

Railway Age, No. 17, October 21, p. 743.

I. C. adapts **electrification** to terminal traffic. (3 20 words & fig.)

Railway Engineer. (London.)

1922 656 .25

Railway Engineer, October, p. 371.

Transient **track circuits.** (1 400 words & fig.)

1922 621 .

Railway Engineer, October, p. 377.

HOWELL (A. E.). — Modern production and costin **methods in locomotive shops.** (3 200 words, tables & fig.

1922 625 .232 (.593

Railway Engineer, October, p. 383.

Restaurant and sleeping cars for the Siamese Stat Railways. (1 300 words & fig.)

Railway Gazette & News. (London.)

1922 656 .253 & 656 .25

Railway Gazette & News, No. 14, October 6, p. 420.

The **Kerr automatic train control** and fog signallin apparatus. (2 000 words & fig.)

1922 625 .232 (.42

Railway Gazette & News, No. 15, October 13, p. 447.

New Pullman **dining and buffet cars.** (900 words & fig.

1922 621 .

Railway Gazette & News, No. 15, October 13, p. 454.

Machine tools for railway shops. (450 words & fig.

1922 385 .57 (.42) & 385 .586 (.42

Railway Gazette & News, No. 16, October 20, p. 479.

Recruiting and training of **railway staff.** (1 800 words.

1922 656 .257 (.73

Railway Gazette & News, No. 17, October 27, p. 509.

Long-distance operation of **facing points.** (1 000 word & fig.)

1922 621 .132.8 (.54

Railway Gazette & News, No. 17, October 27, p. 513.

New rack locomotives for the South Indian Railway (600 words & fig.)

1922 621 .335 (.494)
Railway Gazette & News, No. 17, October 27, p. 515.
New motor coaches for the Burgdorf-Thun Railway. (1 500 words & fig.)

Railway and Locomotive Engineering. (New York.)

1922 621 .133.3
Railway and Locomotive Engin., No. 10, October, p. 255.
FOWLER (G. L.). — The effect of polarized mercury on boiler tubes. (2 200 words & fig.)

1922 621 .131.2
Railway and Locomotive Engin., No. 10, October, p. 259.
The rise of the firing floor. (1 800 words & fig.)

1922 656 .212.6
Railway and Locomotive Engin., No. 10, October, p. 262.
A box car unloader for grain. (5 700 words & fig.)

Railway Magazine. (London.)

1922 656 .222.1 (.42)
Railway Magazine, No. 305, November, p. 345.
ALLEN (C. J.). — British locomotive practice and performance. (4 000 words, 2 tables & fig.)

1922 625 .616
Railway Magazine, No. 305, November, p. 370.
Petrol locomotives for standard and narrow gauge railways. (1 800 words & fig.)

Railway Maintenance Engineer. (Chicago.)

1922 625 .143.2 (.42)
Railway Maintenance Engineer, No. 9, September, p. 306.
New British rail specification. (350 words.)

1922 625 .175
Railway Maintenance Engineer, No. 9, September, p. 307.
Motor cars cut maintenance costs. (1 000 words & fig.)

1922 625 .144.4
Railway Maintenance Engineer, No. 9, September, p. 323.
Gas engine driven bonding drill. (200 words & fig.)

1922 721 .9
Railway Maintenance Engineer, No. 10, October, p. 337.
KIRCHER (P.). — How to handle and lay concrete pipe. (2 500 words & fig.)

1922 621 .133.7 (.73)
Railway Maintenance Engineer, No. 10, October, p. 344.
KOYL (C. H.). — Extensive water treating facilities established on the St. Paul. (1 700 words & fig.)

1922 691
Railway Maintenance Engineer, No. 10, October, p. 349.
TOMLINSON (D. A.). — Promoting the art of making good concrete. (2 000 words & fig.)

Railway Mechanical Engineer. (New York.)

1922 621 .131. (01
Railway Mechanical Engineer, No. 10, October, p. 562.
Dynamometer tests of the locomotive booster. (2 200 words & fig.)

1922 621 .133.1
Railway Mechanical Engineer, No. 10, October, p. 565.
DAVENPORT (J. E.). — Effect of tonnage and speed on fuel consumption. (2 700 words, 1 table & fig.)

1922 621 .134.1 & 669 .1
Railway Mechanical Engineer, No. 10, October, p. 569.
FINCH (R. J.). — Alloy steel reduces weight of locomotive parts. (1 200 words, 2 tables & fig.)

1922 625 .23 (09.3 (.73)
Railway Mechanical Engineer, No. 10, October, p. 572.
Interesting examples of passenger car development. (2 200 words & fig.)

Railway Review. (Chicago.)

1922 625 .11 (.73)
Railway Review, No. 13, September 23, p. 399.
Construction of the Oregon California & Eastern Ry. (900 words & fig.)

1922 725 .33 (.73)
Railway Review, No. 13, September 23, p. 405.
New engine house construction on the Southern Pacific. (800 words & fig.)

1922 625 .123 & 721 .9
Railway Review, No. 13, September 23, p. 407.
KIRCHER (P.). — Laying concrete culvert pipe. (2 000 words & fig.

1922 621 .132.8 (.71)
Railway Review, No. 14, September 30, p. 433.
Design and operation of the Unit Railway steam car. (2 500 words & fig.)

1922 625 .242 & 625 .246
Railway Review, No. 15, October 7, p. 467.
PILCHER (J. A.). — The design of modern steel freight car equipment. (5 700 words & fig.)

1922 621 .133.7 (.439)
Railway Review, No. 15, October 7, p. 475.
KISS (D. L.). — Steam desaturators applied to Hungarian motive power. (1 900 words & fig.)

1922 621 .131.3 (.73)
Railway Review, No. 16, October 14, p. 509.
The performance of locomotive 7000 on the Union Pacific. (2 300 words & fig.)

1922 385. (09.3 (.73)
Railway Review, No. 16, October 14, p. 514.
Beginning of the Rock Island System, now 70 years old. (8 000 words & fig.)

Railway Signal Engineer. (Chicago.)

1922 656 .254
Railway Signal Engineer, No. 10, October, p. 377.
FUGINA (A. R.). — Signal indications replace train orders. (1 700 words & fig.)

1922 656 .254 (.94)
Railway Signal Engineer, No. 10, October, p. 379.
RAYNAR WILSON (F.). — **Single track signaling** in Australia. (3 000 words & fig.)

1922 656 .256
Railway Signal Engineer, No. 10, October, p. 383.
ESTWICK (C. F.). — **D. C. track circuits** with welded bonds. (3 500 words & fig.)

1922 656 .281 (.73)
Railway Signal Engineer, No. 10, October, p. 387.
I. C. C. report on Winslow Junction **accident.** (2 800 words & fig.)

1922 656 .25
Railway Signal Engineer, No. 10, October, p. 390.
VIEILLARD (L. F.). — Theory and use of **electrical instruments.** (3 500 words & fig.)

1922 656 .256
Railway Signal Engineer, No. 10, October, p. 394.
JOHNSON (R.C.). — Locating **automatic block signals** for heavy traffic. (5 000 words & fig.)

Tramway and Railway World. (London.)

1922 621 .33 (.81)
Tramw. & Ry. World, No. 18, October 12, p. 169.
Electrification of the Paulista Railway. (2 200 words & fig.)

Transport & Travel Monthly (London.)

1922 621 .132.3 (.42)
Transport & Travel Monthly, No. 150, October, p. 240.
Rebuilt **4-4-0 Express Locomotive,** London Brighton and South Coast Railway. (1 500 words & fig.)

In Italian.

Giornale del genio civile. (Roma.)

1922 621 .31 (.45)
Giornale del genio civile, 31 agosto, p. 505.
Il problema idroelettrico in Italia e l'attivita' delle imprese elettriche. (5 400 parole.)

1922 628
Giornale del genio civile, 31 agosto, p. 516.
La disincrostazione delle condutture d'acqua. (1 300 parole & fig.)

1922 656
Giornale del genio civile, 31 agosto, p. 521.
L'organizzazione terrestre delle linee di **navigazione aerea.** (1 300 parole.)

1922 656 .1 (.4
Giornale del genio civile, 31 agosto, p. 523.
Lo sviluppo dei **trasporti automobilistici** in Ital
(3 800 parole.)

1922 385 .113 (.4
Giornale del genio civile, 31 agosto, p. 529.
Lo sviluppo delle ferrovie italiane al 30 giugno 19
(600 parole & tavole.)

1922 625 .13 (.46
Giornale del genio civile, 30 settembre, p. 564.
FRANCESCATO (F.). — Lavori di **ricostruzione del** galleria di mora di Rubielos lungo la Ferrovia Centra di Aragona. (Spagna). (2 200 parole & fig.)

Rivista tecnica delle ferrovie italiane. (Roma

1922 656 .257 (.4
Rivista tecnica delle ferrovie, No. 3, 15 settembre, p. 7
PALMIERI (G. C.). — **L'illuminazione elettrica** d segnali nelle stazioni di Padova Centrale e Pado Campo di Marte. (5 000 parole & fig.)

Rivista dei trasporti. (Milano.)

1922 385. (09.1 (.4
Rivista dei trasporti, No. 9, settembre, p. 103.
La ferrovia Erba-Canzo-Asso. (1 800 parole & fig.)

In Dutch.

Ingenieur. ('s-Gravenhage.)

1922 621 .31 (.9
Ingenieur, N^r 39, 30 September, p. 774.
GROOTHOFF (A.). — Een en ander over de on wikkeling van **waterkracht- en electriciteitsbedrijv** voor de energievoorziening van belangrijke gebieden Ned.-Indië. (5 200 woorden, 3 tafereelen & fig.)

1922 621 .116. (
Ingenieur, N^r 39, 30 September, p. 781.
BIEZENO (C. B.). — **Bijdrage tot de berekening v ketelfronten.** (1 900 woorden & fig.)

1922 621 .116 & 621 .133
Ingenieur, N^r 40, 7 October, p. 789.
GOUDRIAAN (J.). — Normalisatie van **pijpleiding en toebehooren.** (6 800 woorden & fig.)

1922 623. (04 & 721 .9 (
Ingenieur, N^r 43, 28 October, p. 856.
Gewapend- en ongewapend beton in de versterking kunst. (12 000 woorden.)

Locomotief. (Rotterdam.)

1922 621 .131
Locomotief, N^r 42, 18 October, p. 331.
Al of niet hooge ligging van den **locomotiefket** (1 300 woorden & fig.)

ANALYTICAL TABLE OF ARTICLES

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CONTENTS OF THE NUMBER FOR DECEMBER 1922.

Alphabetical Index of Advertisements

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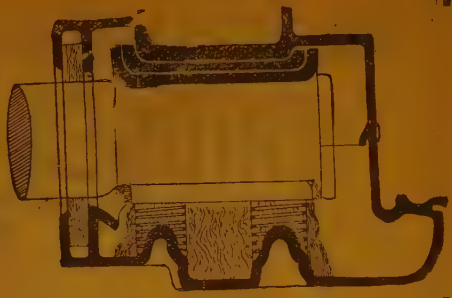

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CONTENTS.

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